Constructing a Green Revolution: A socio-technical analysis of input-support programmes for smallholder farmers in Western Kenya

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Statement

I hereby declare that this thesis has not been and will not be, submitted in whole or in part to another University for the award of any other degree.

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SUMMARY

This thesis presents a critical reflection on what is meant by a 'Green Revolution' within the current, narrow 'productivity-technology fix' paradigm. It shows the current focus on productivity is creating a limited view of technology as the principal means to address food insecurity in Africa, as opposed to a more comprehensive view that takes into account economic, social and political factors. The research combines a socio-technical systems approach with an actor-oriented analysis to examine two input-support programmes in Kenya. It focuses on input-support programmes due to the current interest in subsidies as the mechanism to address food insecurity and deliver agricultural technologies to smallholder farmers. It examines the political, social and institutional factors that influence the creation, design and implementation of these programmes. A multi-level approach (global, national and local) is used to map out the key narratives and actor networks operating in and across the different levels to highlight the dynamic interactions as they come together through these programmes. The thesis demonstrates how intermediary factors (institutions, policy and social networks) significantly affect programme outcomes. The two case studies show that policy and practice often diverge through changing actors, networks and funding flows. Each programme implementation is mediated through socially differentiated beneficiaries, creating interactions that unfold in numerous ways due to distinct social, political and economic factors, as well as to unique institutional and delivery mechanisms. The evidence suggests that technology-based programmes that fail to take account of these critical factors will encounter difficulties in uptake. Therefore, policymakers must consider context-specific approaches that appreciate the diversity of local conditions and the importance of socio-economic, institutional and political factors. The underlying message is that the impact of agricultural technologies on the practices and perceptions of smallholder farmers cannot be understood in isolation; end users constantly adapt technologies through complex social interpretations, local institutions and political processes.

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Abbreviations

ASDS	Agricultural Sector Development Strategy
ASN	Ammonium Sulphate Nitrate
AU	African Union
CAADP	Comprehensive Africa Agriculture Development Programme
CABP	Centre for African Bio-Entrepreneurship
CAN	Calcium Ammonium Nitrate
CGIAR	Consultative Group on International Agricultural Research
CNFA/AGMARK	Citizen's Network for Foreign Affairs/Agricultural Market Development Trust
DAO	District Agriculture Officer
DAP	Di-Ammonium Phosphate
DFID	Department for International Development
FAO	Food and Agriculture Organization of the United Nations
FURP	Fertiliser Use Recommendation Project
GDP	Gross Domestic Product
GIZ	German Agency for International Cooperation
GOK	Government of Kenya
HH	Household
ICRAF	World Agro-forestry Centre
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDP	Internally Displaced Persons
IFPRI	International Food Policy Research Institute
JICA	Japan International Cooperation Agency
KARI	Kenya Agricultural Research Institute
KEBS	Kenya Bureau of Standards
KEFRI	Kenya Forestry Research Institute
KNBS	Kenya National Bureau of Standards
MDG	Millennium Development Goals
MFI	Micro-Finance Institution
MLP	Multi-Level Perspective
MVP	Millennium Villages Project
NAAIAP	National Accelerated Agricultural Input Access Programme
NCPB	National Cereals and Produce Board
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organisation
NPK	Nitrogen Phosphorus Potassium
Saga	Saga Thrift and Enterprise Promotion Ltd.
SAP	Structural Adjustment Programmes
SCOBICS	Sustainable Community-Based Input Credit Scheme
SOAS	School of Oriental and African Studies
SRA	Strategy for Revitalising Agriculture
SSP	Single-Superphosphate
TOT	Training of Trainers
UNDP	United Nations Development Programme
USAID	United States Agency for International Development

Chapter 1

Introduction:

Understanding food insecurity in a changing world

Rising food prices in 2008 and again in 2011 have once again prompted growing concern about a deepening global food crisis. Food price volatility over this period, coupled with the global economic downturn experienced in 2009, has had a devastating effect on the world's vulnerable populations and increased the total number of people that are hungry and malnourished. Price spikes in early 2011 have been blamed for pushing an additional 44 million people into poverty (World Bank, 2011a: 1), with the total number of people suffering from hunger reaching close to one billion (FAO, 2010a: 1). Sub-Saharan Africa has been hit especially hard by these crises (World Bank, 2011b).[1] Rising food prices, coupled with declining per capita food production and increasing populations, conflicts and droughts, have driven Africa's food security challenge to the top of the international agenda.

Yet, the story of rising food insecurity in Africa is much more complicated than it first appears, and the continent has seen its share of successes and advancements. Africa has made impressive gains in agricultural productively since the mid-1990s. By 2008, Africa's economy had been growing by five percent per year over the past 10 years (World Bank, 2011b: 130). However, for the most part, these successes have remained in high-potential pockets, beyond the reach of millions of smallholder farmers who rely on less than one hectare of land to feed their families. Africa continues to suffer from increasing household food insecurity and rising rates of child malnutrition compared with other regions of the world (FAO, 2004a, 2009). Africa also has the highest percentage of people (30 percent) suffering from malnutrition (FAO, 2010b: 11). Furthermore, rising energy costs have led to increasing costs for such agricultural inputs as fertiliser, by as much as 50 percent (FAO, 2009: 25), leaving many poor smallholder farmers unable to purchase improved inputs and pushing the vulnerable further into poverty.

[1] From here on Africa will refer to sub-Saharan Africa, excluding South Africa.

The FAO hunger map (Figure 1) shows the prevalence of very high rates of chronic hunger in large parts of Africa.

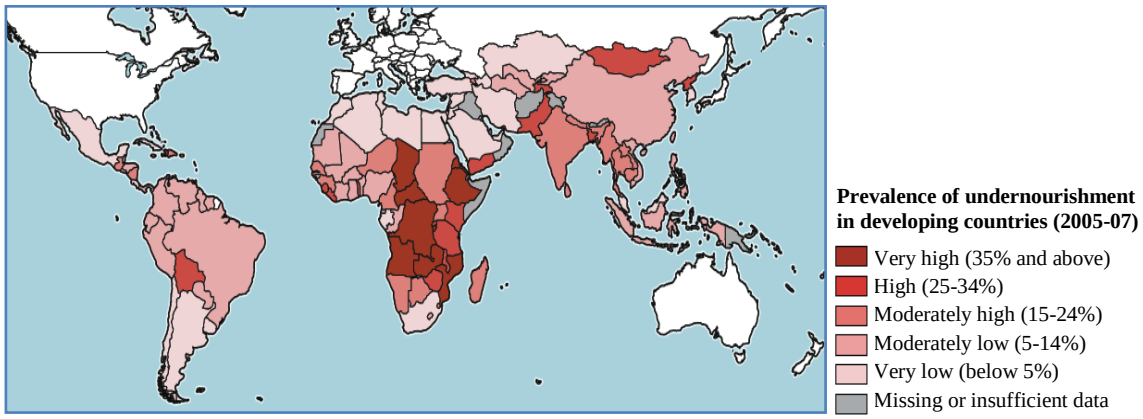

Figure 1: Prevalence of undernourishment in developing countries (Source: FAO, 2010c)

The threat of an ever-increasing and deepening food security crisis is creating a new era of uncertainty and forcing African governments and the donor community to refocus on the needs of the rural poor. Now, after years of neglect and diminishing funding, agriculture and rural development are back on the development agenda. However, the success of efforts to alleviate food insecurity in Africa will be determined by the way in which the initiatives are designed, the language and storylines that drive their development, and the method by which they are implemented.

In this thesis, I argue that complex pressures surrounding rising food insecurity and decreasing productivity are contributing to policymakers oversimplifying the problem and ignoring the diverse ecological, social, economic and political dimensions that contribute to the problem. Therefore, policymakers continue to promote narratives, or storylines, that define food security interventions narrowly, i.e., based on simplistic solutions that rely on productivity as the primary means of addressing food insecurity. The growing attention put on this productivity narrative has created a limited view of technology as the way to address food insecurity in Africa in many agricultural policy debates, to the detriment of other multi-dimensional solutions. This has led to the creation of food security programmes that focus exclusively on technology interventions and ignore many of the more complex factors and power relations that surround local farming systems.

Therefore, the task of this thesis is to explore how an exclusive focus on productivity, instead of a more comprehensive look at the economic, social and political factors that affect food insecurity, has led to misplaced policy decisions focused on the delivery of technology to the food insecure. I use a case study approach to examine how these narratives and the resulting technology-focus programmes, which offer hybrid seed and inorganic fertilisers, play out in practice. These programmes, such as Malawi's Agricultural Input Subsidy Programme, are currently influencing the food security debate and focusing discussions on a predetermined package of interventions for African smallholder farmers as the solution to food insecurity (cf. Chirwa et al., 2006; Morris, 2007; Chinsinga, 2008; SOAS et al., 2008; Sanchez et al., 2009; Chinsinga, 2011). Through this exploration, I draw out some broad lessons from current trajectories and highlight alternative narratives that broaden the scope of the debate.

Through this research, I assert that the thinking around food insecurity must go further than that currently proposed by agricultural support programmes to incorporate a broader approach that considers the unique political, institutional and social contexts surrounding local settings. This research adds to the development literature by including an analysis of the social and human factors affecting technology uptake and highlighting the interface between technologies and human interactions (Long, 1989; Orlikowski and Barley, 2001). Richards (1985: 12) showed how many of Africa's problems are "localized and specific, and require local, ecologically particular, responses". Therefore, this thesis also builds on previous work by asking how will current food security programming, which is constructed within a 'Green Revolution'[2] narrative focused on a narrow set of exogenous technologies, offer site- and context-specific responses to Africa's increasingly complex, diverse and risk-prone farming environments?

[2] There has been much written about the original 'Green Revolution' (covered in Chapter 3), however a small sampling of the literature includes: Boserup (1965), Borlaug (2000), Byerlee and Eicher (1997), Cleaver (1972), Conway (1997; 2007), Djurfeldt (2005b), Ehrlich, (1968), Hazell and Ramasamy (1991), Lipton and Longhurst (1989), Perkins (1997), Sen (1981), and Shiva (1991).

Linking food security, soil fertility and productivity narratives

The concept of food security has continued to evolve over the past few decades. The term originated during the mid-1970s, when the world was experiencing a global food crisis. At that time, the definition was limited to production and improvement of food supply (United Nations, 1975). However, over the years, the term has expanded to include access to food, and to distinguish between short-term hunger, associated with natural disasters and conflicts, and longer-term chronic food insecurity, associated with structural problems concerning poverty (Sen, 1981). The World Food Summit (1996) expanded the food security definition to represent a situation that exists when "all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996). This definition includes multidimensional aspects, such as access to and availability of food, the appropriate use of food, and the stability of food sources over time. Since then, the concept of food insecurity has evolved even further to include sustainable national food production, analysis of household level vulnerability and risk, and examination of the economic, social and political factors that affect food security (Devereux and Maxwell, 2001).

With the latest food price crises, in 2008 and again in 2011, governments and donors are revising their analysis of the root causes of food insecurity, and seeking to develop policies to spark a new 'Green Revolution' for Africa. Policymakers are increasingly under pressure to address a host of complex issues surrounding the underlying causes of food insecurity within increasing environmental, economic and political uncertainties and mounting pressures from rising poverty and declining soil fertility in Africa. However, these food security policies are often constructed at a national level to reflect particular social, political and institutional interests. There remains no unified view on how to address policy issues surrounding food insecurity, leading to growing debates about the best methods to reach national food security and to engage agriculture as the engine of growth for Africa (Holmén, 2003; Johnson et al., 2003; Eilitta, 2006; Wiggins and Leturque, 2010).

Embedded in this food security debate are a series of different narratives, or storylines, which aim to identify the root causes of food insecurity based on the unique perspectives and beliefs of the storytellers. Roe (1991: 288) argues:

> *These narratives tell scenarios not so much about what should happen as about what will happen – according to their tellers if the events or positions are carried out as described.*

These narratives are simplifications of complex situations that are used within high-level debates to influence and legitimise a certain trajectory of actions and policies. When powerful networks of actors support a specific narrative, it begins to dominate discussion and debate and ultimately can shape judgement and behaviour. However, if the premise that the narrative is based on is flawed, then the entire set of actions, plans, programmes and policies that follow will be misconceived (Keeley and Scoones, 2003). Moreover, powerful actors may use these simplified narratives to pursue a particular policy direction based on their own understandings and/or interests that may ultimately have different objectives than the narratives used for that purpose. Therefore, it becomes important to understand the set of assumptions and premises under which a narrative exists.

There are various versions of the food security narrative that focus on technology as a solution to the problem. For example, one recurring narrative proposes that Africa's food security dilemma is strictly a problem of productivity. It argues that the best way to address Africa's increasing food insecurity is to fix declining productivity levels, which will improve the economy and reduce poverty. In agronomic terms, this productivity narrative advocates a focus on improving the input constraints; i.e., improve the availability of such productive assets as hybrid seed, fertiliser, irrigation and micro-credit. Another related narrative blames Africa's increasing food insecurity on a rising population and declining soil fertility, which in turn is affecting agricultural development (Larson and Frisvold, 1996; Buresh et al., 1997; Johnson et al., 2003; Otsuka and Kalirajan, 2005). In this population and environmental management narrative, overcoming Africa's food security problems means addressing its declining soil fertility through better management of the agro-ecological system, more research into new technologies, and a focus on improving fertiliser usage (especially inorganic fertilisers) to replenish the soil's lost nutrients. The common element in both these

narratives is the centrality of technology and how it should be used to address the current food insecurity problem in Africa.

Yet Africa, unlike parts of Asia that experienced the first Green Revolution in the 1960s–70s, has much greater variety in agro-ecologies and farming systems, along with a wide range of agronomic and institutional constraints. Africa has more fragile and variable soils, with unpredictable rainfall and little irrigation. Most food-insecure farmers are too vulnerable to changing shocks and conditions to be locked into a system based on technological solutions, such as inorganic fertiliser (Harsch, 1998). This diversity implies that:

> *...a multitude of different technology solutions are required rather than single technology packages that were appropriate for vast and homogenous cropping areas in India* (Johnson et al., 2003: 7).

Therefore, I contend that this diversity requires a more comprehensive approach than a single focus on productivity and soil fertility. Africa requires a more site-specific solution to take into account the complexities of the continent. I argue that current perspectives surrounding food insecurity have been 'locked-in' (Geels, 2004: 910) to a certain technology-laden approach that is further reinforced by policymakers and programme developers. These narrow policies are constructing particular trajectories for agricultural programming that will have long-term implications for smallholder farmers in Africa (cf. Lawrence, 1988; Turner et al., 1993; Heisey and Mwangi, 1996; Larson and Frisvold, 1996).

These emerging food security approaches in Africa need to be analysed at different levels, global to local, to understand how the storylines have developed over time, how they affect the ability of actors at different levels to understand each other, and the consequences on food security programmes. To analyse how the global macro-level framing of the productivity debate has influenced national approaches, I take a closer look at Kenya, which has long been the testing ground for agricultural technology and policy experiments, to examine how these narratives are transposed and adjusted to fit a unique socio-technical context.

Kenya's agriculture sector and food security situation

Kenya is no stranger to technology-driven agricultural programmes. The country experienced a surge in programmes in the 1960s–1970s that focused on increasing the productivity of the agriculture sector. While such programmes were also implemented during the Asian Green Revolution, the Kenyan model was created with distinctive local characteristics. During this period, Kenya's Green Revolution was essentially 'maize-based' and it was successful in increasing yields in the high potential areas in the west and central parts of the country. Production of export-based maize increased dramatically through heavy government intervention and donor assistance (cf. Heyer and Waweru, 1976; Smith, 1976; Tiffen et al., 1994; Nyangito and Okello, 1998; Wangia et al., 2002; Mango and Hebinck, 2004; De Groote et al., 2005).

However, Kenya's successes in maize production at that time were not uniform across the country, and did little to address the food insecurity faced by vulnerable smallholder farmers within Kenya. Many of the achievements in productivity growth were limited to Kenya's high-potential areas and focused on the export-growing sectors of the economy. Many parts of Kenya, such as the lower highlands in the west, were left with stagnating production and increasing poverty and food insecurity (Heyer and Waweru, 1976). Even the successes in the country's national productivity growth have declined gradually since the mid-1980s. The reasons are varied. Some factors include the withdrawal of government interventions and subsidies in the agriculture sector and a decrease in donor funding for agriculture. According to the World Bank (2009: v):

> *The agriculture sector remains the Achilles' heel of Kenya's economy, both in terms of production and wealth distribution.*

Between 2005 and 2008, Kenya's average annual agricultural growth rate suffered from a large decline, with slight increases in 2009 due mostly to increases in livestock value due to destocking as a result of ongoing drought (Figure 2). Furthermore, the Government of Kenya's Food Security and Nutrition Strategy (2008a: 9) states that in 2008 approximately one-third of the population (10 million people) suffered from food insecurity, based on insufficient dietary energy supply. In 2009, maize yields remained

low at 14.4 bags per hectare,[3] resulting in a total maize production of 27 million bags, a shortfall from the projected consumption level of 36 million bags (GOK, 2010b: 27). This decline in production, coupled with Kenya's rapid population growth and the current food price crisis, has led to a reduction in food production per capita and an increased risk of food insecurity in the future (World Bank, 2009).

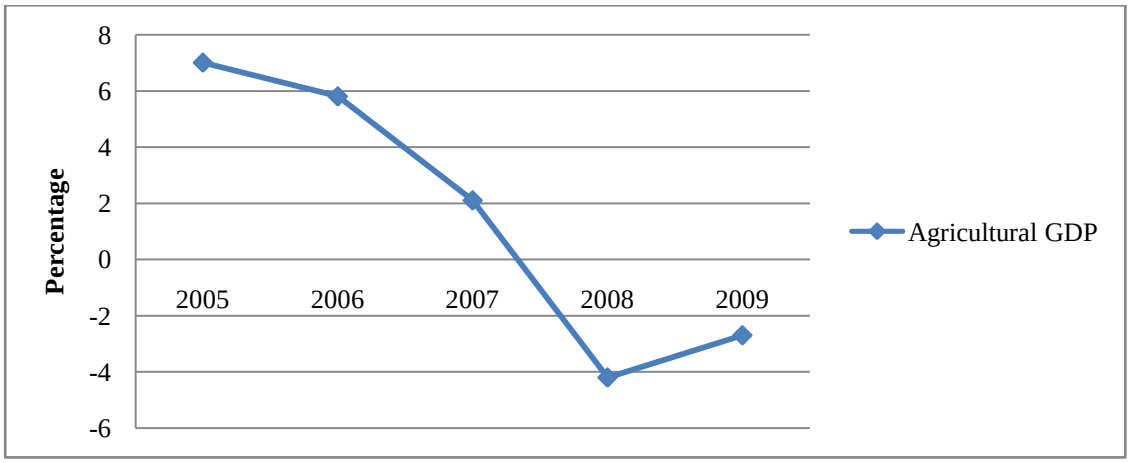

Figure 2: Kenya's Agricultural GDP Growth Rates, 2005-2009 (Source: KNBS, Economic Survey, 2010)

This current state of food insecurity and lagging productivity has prompted a resurgence of interest in agriculture. The Government of Kenya and the donor community have once again begun to invest in the agriculture sector and focus on rural development. Policymakers are keen to construct a distinctively Kenyan Green Revolution that addresses productivity concerns and food security across Kenya. Renewed national food security initiatives are looking to raise maize productivity and the government has turned to input-support programmes as one way to increase access to agricultural inputs for smallholder farmers (GOK, 2010c).

Analysis of input-support programmes

This research takes a specific look at maize production systems, since maize remains the staple food for food-insecure farmers in many parts of Africa, including Kenya. The research examines the actions of policymakers towards maize, which tends to have the greatest impact on food security. Maize is considered "...an important staple crop in

[3] In Kenya, a 90 kilogram bag is a standard measures for maize. Therefore describing yields in terms of bags of maize per hectare is a common practice.

Kenya, socially, politically and economically" (Brooks et al., 2009: 1). This politicisation has created a 'maize-based food security' model that results in the framing of policy options that reinforce a dependence on maize. Furthermore, it leads to the creation of agricultural programmes, such as input-support programmes, that focus on continuing dependency on maize as a food-security crop, even in areas that are better suited to growing different crops. Therefore, this research argues that such policies and social contexts create institutional and administrative functions that reinforce the promotion of input-oriented support programmes as the primary means to help farmers reach food (maize) security, to the exclusion of alternative solutions. The research examines the social, political and institutional factors behind maize-based input support to understand the larger picture behind the Green Revolution narratives and technological focuses currently used to address food insecurity.

A common characteristic of input-support programmes is the combination of both hybrid seed and fertiliser into the package mix. While the use of both hybrid seed and fertiliser is examined, this thesis has a particular focus on inorganic fertiliser due to the growing narrative of a soil fertility crisis in Africa and the increasing debate about fertiliser as the 'solution' for food-insecure smallholder farmers (Quifiones, 1997; Wanzala et al., 2001; Crawford et al., 2006; Morris, 2007). Critics point to continuous cultivation and the lack of input use as the leading cause of soil nutrient depletion and decreasing yields, which lead to persistent food insecurity (cf. Buresh et al., 1997; Smaling et al., 1997). As a result, a focus on increasing smallholder farmers' use of fertiliser to improve yields and attain food security has rapidly taken centre stage (World Bank, 1996; Quifiones, 1997).

The core of my research consists of an examination of two contemporary case studies that demonstrate how different agricultural programmes understand and implement technology-driven initiatives for food-insecure smallholder farmers. The focus is on the consequences for smallholder production and the longer-term sustainability of the technologies. The aim is to contrast two approaches, drawing out the ways in which the mainstream narratives, centred on a technology solution to the productivity gap, played out and highlighting the limitations and interactions within each programme. The analysis used in this thesis is set within a wider context of policy processes that have led to these implementation designs (see Chapter 3).

The aim is not to evaluate whether technologies such as inorganic fertilisers are the best technologies in a given area, but to focus on the social, political and institutional conditions that influence the adoption and sustained use of a technology within a given locality. Through the case studies, I argue that the formulation and delivery of input-support programmes at the national and global levels will affect the interactions of the technologies at a local level. The rationale for choosing these two case studies is to compare the different input programmes and their implications for other countries within Africa. Both programmes use the same technology package (i.e., hybrid seed and fertilisers), but differ in the principles, design and delivery of the packages to the end users. Therefore, this research explores the ways in which the two contrasting programmes are developed and delivered. The following text briefly describes the two programmes (Chapters 6 and 7 provide more detail).

Case 1 – Millennium Villages Project

The Millennium Villages Project (MVP) is a donor-led, community-based approach to achieving the Millennium Development Goals (MDGs). The MVP is an integrated, area-based model, addressing issues of health, education, agriculture and environment. However, the focus for this research is on the agriculture programme and specifically on its input-support programme. I examine the delivery of MVP's input-support programme to determine what the outcomes have been in terms of the adoption and sustained use of the inputs. MVP operates within 10 countries in Africa. I choose the MVP site in Western Kenya –Siaya District– for this research because it was the project's first site, launched in 2004, and provides an interesting view of the input-support programme's institutional and administration evolution over six years of operation. My rationale for choosing a high-profile programme such as MVP is that it represents a unique, donor-driven, integrated approach that combines a high focus on technology with strong community-driven and bottom-up components.

Case 2 – National Accelerated Agricultural Input Access Programme

In 2007, the Government of Kenya launched its national input support initiative, the National Accelerated Agricultural Input Access Programme (NAAIAP), which aimed

to reach 2.5 million farming households with affordable farm inputs in three to five years. The programme consists of a predetermined package of subsidised inputs for smallholder farmers. I examined one site in Western Kenya (Butere District) where farmers have received the Government's package of hybrid maize seed and inorganic fertiliser. NAAIAP is an interesting study of a national programme directly addressing the issues of agricultural growth through input support. It also provides a useful comparison case study as it uses a similar technology package to the MVP, with the same rationale to address productivity among food-insecure farmers. However, both programmes are administered and delivered through very different mechanisms, with varying levels of financial, technical and institutional resources. Due to its national scope and scale, programmes such as NAAIAP and Malawi's input support programme have garnered interest from other African governments wishing to implement similar subsidy projects. Therefore, the research results may offer policy options and practical solutions for nationally led input-support programmes.

The two contrasting case studies have diverse political, economic and institutional foundations and implementation structures. This thesis provides a detailed comparison, looking not only at their delivery of similar packages of technologies (hybrid seed and fertilisers), but also at their distinctive design, implementation and administration. Through this study, I identify and critically examine the crucial factors that led to both positive and negative outcomes and impacts for different stakeholders associated with the two initiatives. Ultimately, I show how the narratives, design and implementation of these programmes have affected the uptake of the technology and the interactions with participants.

Other African countries (i.e., Ghana, Nigeria, Tanzania and Zambia) are currently implementing – or revisiting models on how to implement – similar input-support programmes (SOAS et al., 2008; Dorward, 2009; Xu et al., 2009; Baltzer and Hansen, 2011; Banful, 2011; Mason and Ricker-Gilbert, 2012). Therefore, the analysis of these specific sites offer insights well beyond Western Kenya, and the results could assist additional governments and donors in developing food security programmes across the region. By comparing the two programmes, I provide some overarching lessons and recommendations for future input-support programmes focused on food-insecure farmers.

Overview of chapters

Chapter 2 covers the theoretical base and offers an overview of the literature surrounding these theories. It outlines how I combined the socio-technical systems theory with a policy processes approach to create a unique conceptual framework to fit this specific agricultural, socio-cultural and technological context. It explains the multi-level perspective used in the research to examine the construction and delivery of input-support schemes through three different levels (global, national and local). The chapter then explains the research methodology that combined historical and qualitative enquiry across the three levels, and the design of the individual household-level case studies that provided insight into the overall agricultural system at the local level.

Chapter 3 presents an analysis of the Green Revolutions – Asian, African and Kenyan – to explain how politics, institutions and social factors affect the design, process and outcomes of input-support programmes. The Asian Green Revolution is often described as set of technological packages delivered to increase agricultural productivity in Asia in the 1960s (Djurfeldt et al., 2005a). This chapter demonstrates how the success or failure of the technology interventions used must be viewed within the particular administrative, political, social and delivery systems that were prevalent in Asia at that time (cf. Hossain and Singh, 2000; Johnson et al., 2003; Djurfeldt et al., 2005b). The chapter outlines the impact of the Asian Green Revolution narratives on the construction of the current 'African Green Revolution'. It shows that even with the diversity of the African landscape and lessons learned from the Asian Green Revolution, the solution for Africa's agriculture remains centred on technical 'fixes', with less attention paid to socio-economic, political and institutional factors (cf. Eicher, 1995; Rosset, 2000; Johnson et al., 2003; Scoones et al., 2005).

Chapter 4 describes Kenya's current national socio-technical landscape to show the key political, institutional and social aspects that affect food security policies and programmes aimed at smallholder farmers. The chapter begins with an overview of Kenya's agricultural history to see why the agricultural institutions and polices remained relatively stable from pre-independence to the present. The purpose is to

frame how Kenya's agrarian evolution has affected the creation of Kenya's institutions, administration and policies, and how it continues to affect current policies (cf. Bates, 1989; Berman, 1991; Berman and Lonsdale, 1992; Swallow and Kamara, 2000). This chapter shows how actors within particular institutions and administrative arrangements construct narratives in particular ways (e.g., through practices, incentives, histories, etc.) to advance various interests and agendas and ultimately influence the design and implementation of input-support programmes in Kenya.

Chapter 5 narrows the focus to a micro (community/village) level to explore the socio-technical dynamics within the two research sites: Butere and Siaya Districts in Western Kenya. It argues that the technologies are not disembodied artefacts, but are embedded in the wider socio-technical system that has a history, cultural context and institutional dimension, and is informed by highly differentiated farming and cultural practices. This chapter analyses the local administration, politics and social practices that shape and affect how a community interacts with technology. It shows how users adopt, adapt or reject new technologies through social interpretations, local institutions and politics.

Chapters 6 and 7 represent a household-level analysis of the two input-support programmes, MVP and NAAIAP. The analysis of the case studies is based on the foundations set in the previous chapter and shows how political, institutional and social factors interact at the community and household level within a wider socio-technical system. Both programmes use the same technology package (i.e., inorganic fertiliser and hybrid maize seed) but the principles, design and delivery of both programmes are very different. This research explores the ways in which the two programmes understand the delivery of fertilisers and points out how local socio-technical factors affect programme outcomes. The chapter also examines the evolution of institutional factors and knowledge–power relations surrounding the two input-support programmes.

Chapter 8 brings together the two empirical case studies and draws conclusions by examining the outcomes of adoption and sustained use of the inputs. It compares the narratives, design and delivery of the programmes, and also the response and uptake from the communities. It outlines how certain programme features have affected adoption rates and outcomes. This is not an evaluation of success or failure, but an

analysis of the socio-technical factors that interact with the technology-focused programmes when they are introduced at the household level.

Chapter 9 concludes the thesis by offering a critical reflection of what is meant by a 'Green Revolution for Africa', highlighting some missing facets of the agenda. By taking apart the different components of a Green Revolution, this chapter offers an alternative to the typical articulation by incorporating some components of the socio-technical systems perspective. The thesis concludes with suggestions for future technology-focused programmes designed for food-insecure farmers in Africa.

Chapter 2

Conceptual Framework and Methods

Current studies of 'technoscience' view agriculture as a "near perfect embodiment of the 'seamless web' of social, technical, economic and political dimensions" (Shrum, 2000: 96). Building on this statement, this research takes certain aspects of the technoscience view of agriculture to examine how technology-based interventions are created for food-insecure smallholder farmers in Kenya and outlines the factors that influence their application. The research draws from related 'science in society' approaches, such as socio-technical systems analysis, to define agriculture as a system encompassing the *production* of the artefacts (e.g., fertiliser), with the actual *use* of these technologies in a given locality (Geels, 2004; Geels and Schot, 2007). By bringing these strands together, the research examines input-support programmes through a wider lens, exploring the hypothesis that politics, economy and social context matter just as much as technology in generating sustainable increases in agricultural productivity and ensuring food security for African smallholder farmers.

Conceptual framework

The thesis brings together two contrasting but complementary conceptual strands of study –socio-technical systems and policy studies– to form a hybrid conceptual framework through which to guide the research. It draws on a range of literature, including recent work on socio-technical systems (Kemp and Rotmans, 2001; Berkhout et al., 2003; van der Ploeg et al., 2004; Wiskerke and van der Ploeg, 2004; Geels, 2010, 2011); and policy studies, drawing on the approaches of actor network theory (Callon, 1986; Latour, 1987; Law, 1992; Law and Hassard, 1999; Latour, 2007) and narrative analysis (Apthorpe, 1986; Roe, 1991, 1994; Apthorpe and Gasper, 1996; Grillo and Stirrat, 1997). Within this framework, the research applies insights from the field of science and technology studies to explain the technology focus of much agricultural programming, such as input-support programmes. The scope is widened to include socio-technical theory to ensure that "the fulfilment of societal functions becomes

central" to the focus of the analysis (Geels, 2004: 898). Socio-technical concepts are useful as they allow technological changes to be viewed in a broader and more complex view, with a trajectory that is indeterminate and unknown (Carolan, 2010).

While this research uses socio-technical theory as a starting point, it does not apply the theory completely or exclusively. Instead, I applied selective components of the theory and combined them with elements drawn from other literature to fit my specific research agenda. I expand this work by including an examination of how distinct narratives on food security incorporate a standard view of technologies, such as hybrid seed and fertiliser, which are then embedded in different levels, from global to national to local. In so doing, the research looks at the effect these narratives have on the creation, implementation and impact of input-support programmes. Figure 3 below has been adapted from the socio-technical systems literature to illustrate how the production of agricultural inputs are influenced by a combination of knowledge, capital and labour, and adapted by the end users through their own social interpretations, as well as by local institutions and policy processes (cf. Shrum, 2000; Geels, 2002). The links between the spheres emphasise that technological systems do not function autonomously, but are part of the social constructs created by human actors. It highlights how the sustained use of improved inputs is linked intrinsically to the actors, organisations and social structures that encompass the local farming system.

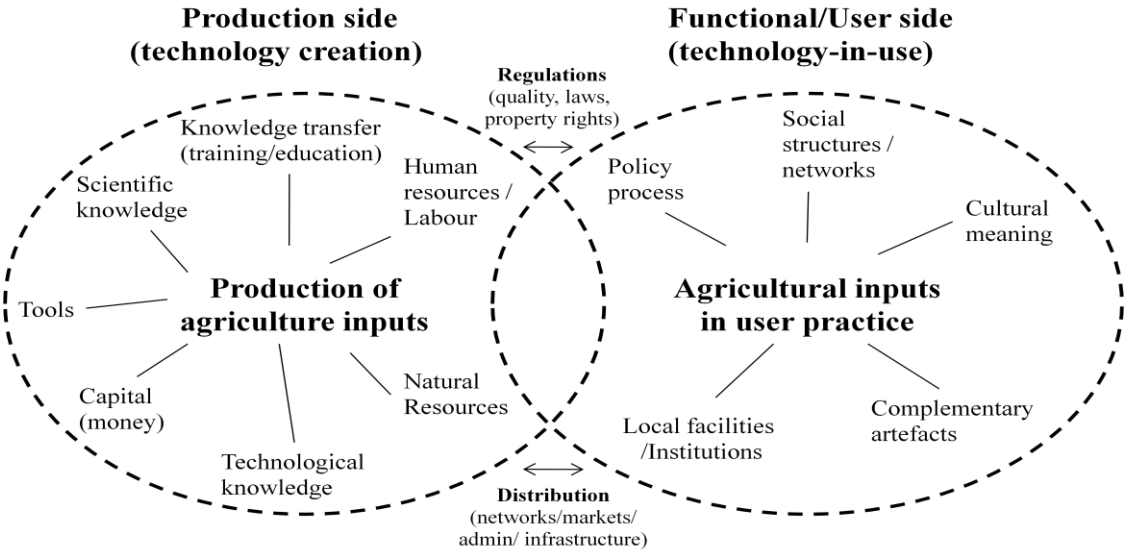

Figure 3: The basic elements of socio-technical systems (adapted from Geels, 2004)

It is within this theoretical framing that the term 'socio-technical system' is broadly used as a "conceptual reminder that technologies affect and are an effect of their broader infrastructural, organizational, regulatory and symbolic environment" (Carolan, 2010: 65). In other words, it is not about the intrinsic workings of a technology –how it works or not– but *how it is embedding into a specific socio-technical system that includes local knowledge, structures and institutions* (Rip and Kemp, 1998: emphasis added). In this thesis I use this framework to examine how existing national systems surrounding food security are "locked in" (Geels, 2005: 682) at multiple dimensions to specific pathways for development and become difficult to change.

To understand the complex system surrounding food insecurity in Africa, it is important not only to identify the social, economic and institutional factors, but also to appreciate the actors, networks and narratives that are shaping and influencing the current Green Revolution trajectories. Appreciating the important role of narratives is crucial to understanding how these storylines influence the creation and maintenance of the structures that promote certain development programmes (Korten, 1980; Hyden, 1983; Roe, 1991). According to Roe (1991: 288), rural development is a complex and uncertain environment. Therefore, the method by which policymakers and development practitioners deal with uncertain situations is to rely on narratives that do away with ambiguities, simplify complexities and help to develop basic sets of programmes for implementation.

However, narratives are not confined to policymakers. Narratives permeate throughout the entire system of decision making, from influencing the creation of regulations to the method of distribution of technologies to the end user. Likewise, narratives are created and shaped by local understanding and social interpretations of local practices, such as soil fertility management and application of agricultural inputs. Different narratives, from decision makers to implementers to end users, are not often in alignment and may at times be conflicting. Therefore, this research demonstrates the interactions, clashes and mismatches of ideas, knowledge and beliefs on how input use, such as hybrid seed and inorganic fertiliser, is understood and represented throughout these levels.

Moreover, narratives do not exist solely in one given timeframe. Therefore, the research highlights how dominant narratives persist through time and resurface even

when there is evidence to suggest they may not be right for a given locality (cf. Cohen and Lewis, 1987; Roe, 1991; Chambers, 1997). Narratives are also used to defend a position about an existing problem, such as a soil fertility crisis, that is then used to influence policy and programmatic directions for input-support programmes (cf. Cohen and Lewis, 1987; Chambers, 1997; Scoones, 2001). Often large amount of time, money and resources go into developing the system to support the narrative, thus building strong opposition and resistance to altering the dominant structures.

To understand the relationships between actors and the different networks/associations that exist, this research draws on aspects of actor-network theory to show how knowledge-power-politics relations contribute (positively or negatively) to development outcomes (Callon and Latour, 1981; Law and Callon, 1992). This 'interface' occurs at multiple levels and includes different knowledge systems and forms of social linkages that situate the interactions within wider institutional, social and political structures (Long, 1989, 2001). According to Long (2001: 191):

> *The concern for interface entails an acute awareness of the ways in which different, possibly conflicting, forms of knowledge intersect and interact.*

Therefore, the thesis outlines the main actors framing the food security debate, both globally and within Kenya's national policy process, to identify whose knowledge is being included or excluded from the policy deliberations (cf. Keeley and Scoones, 2003). It also shows how certain ideas are adopted by powerful actors who find these ideas advantageous in framing the Green Revolution debates so as to influence a particular policy that may not have the same objectives as those supported by the narratives. According to Richards and Diemer (1996: 1):

> *To 'map' the actor-networks that come together in any technology project is a significant step towards understanding the technical design and process and its outcomes.*

To understand the interaction of these different narratives and practices at different scales, the research uses another concept from current socio-technical theory: the multi-level framework.

A multi-level analytical framework

This research takes some liberties in defining a multi-level framework, borrowing loosely from the multi-level perspective (MLP) literature and the ongoing debates on the transitions of socio-technical systems (Kemp et al., 1998; Berkhout et al., 2003; Wiskerke, 2003; Smith et al., 2005; Geels and Kemp, 2007; Genus and Coles, 2008; Geels, 2011). I adapted the multi-level framework to fit the unique construct of this research and drew certain lessons from existing socio-technical systems work to examine the construction and delivery of input-support schemes through three different levels: global (macro), national (meso) and local (micro):

(i) Macro level – This corresponds broadly with the landscape and regime level of the MLP and emphasises the broader political, economic and institutional context that supports such specific elements as infrastructure, political culture, networks, communities, social values, and the macro economy that directly affects agricultural systems and programmes. For example, changes in global food or fertiliser prices, climate change and economic growth will have a dramatic impact on the current macro landscape, which ultimately influences the lower meso and micro levels. Mapping the global landscape is not the focus for the research, but it is important in demonstrating the influence of this macro level on the other levels.

(ii) Meso level – This refers to the interests, rules and beliefs that guide actions and public policy and account for the stability of existing technological development and its trajectories, defining, in the terms of the MLP, the regime. It looks at the technological regimes and supporting narratives that are created at the global level and continue to influence the creation of national-level policies that ultimately shape agricultural programmes. In this instance, regimes refer to the predetermined set of rules embedded in certain practices and technologies that come together to define a problem and become entrenched in institutions and infrastructures (Rip and Kemp, 1998). Therefore, the regime is used to specify the way society produces new agricultural technologies as well as its rules and modalities of operation.

(iii) Micro level –This comprises individual actors (i.e., farmers, farmers' organisations and non-governmental organisations), technologies and local practices involved in agriculture. At this level, the analysis focuses on the environment within which technologies interact with local actors and how they are altered through gradual experimentation and learning, as well as the local administration, politics, social and delivery mechanisms of input-supply programmes. It emphasises how farmers are constantly readjusting their farming practices and adapt to the particular ecological or economic situation they face. These innovations or niches in the micro-level are 'protected spaces' (Kemp et al., 1998: 186) where farmers are able to experiment and create new modes of interactions with technologies that ultimately influence meso-level regimes. Shifts in local social networks and power relations are analysed to understand how they interact with and shape the use of the technology in practice.

The linkages between these three levels can be conceptualised within a multi-level framework (Figure 4). This framework illustrates how factors (such as institutions and social networks) at one level are connected and may influence or interact, positively or negatively, with factors (such as policy or administration) at another level (Kemp and Rotmans, 2001; Geels, 2002; Berkhout et al., 2003; Moors et al., 2004). According to Geels (2002), this relationship can be understood as a nested hierarchy where the three levels are embedded within each other and are heavily influenced by the other.

Building on this framework, I have added in the concept of narratives to this diagram. As mentioned previously, narratives help to shape policy thinking and simplify complex situations. Therefore, the dotted lines in the conceptual diagram below illustrate how narratives at the macro-level not only drive policy at the meso level but at the same time are also used by meso-level actors to influence the global level narratives and objectives. It illustrates how different narratives flow from one level to another and interact with interests at all the multiple levels. However, in doing so they become heavily influenced by the realities of the surrounding environment at each level. It also shows how narratives flowing from the meso-level may strongly influence the micro-level and how experimentation and adaptation can create niches based on their particular ecological, institutional, political or social surrounding that may influence both their interactions with technology and the meso-level regimes.

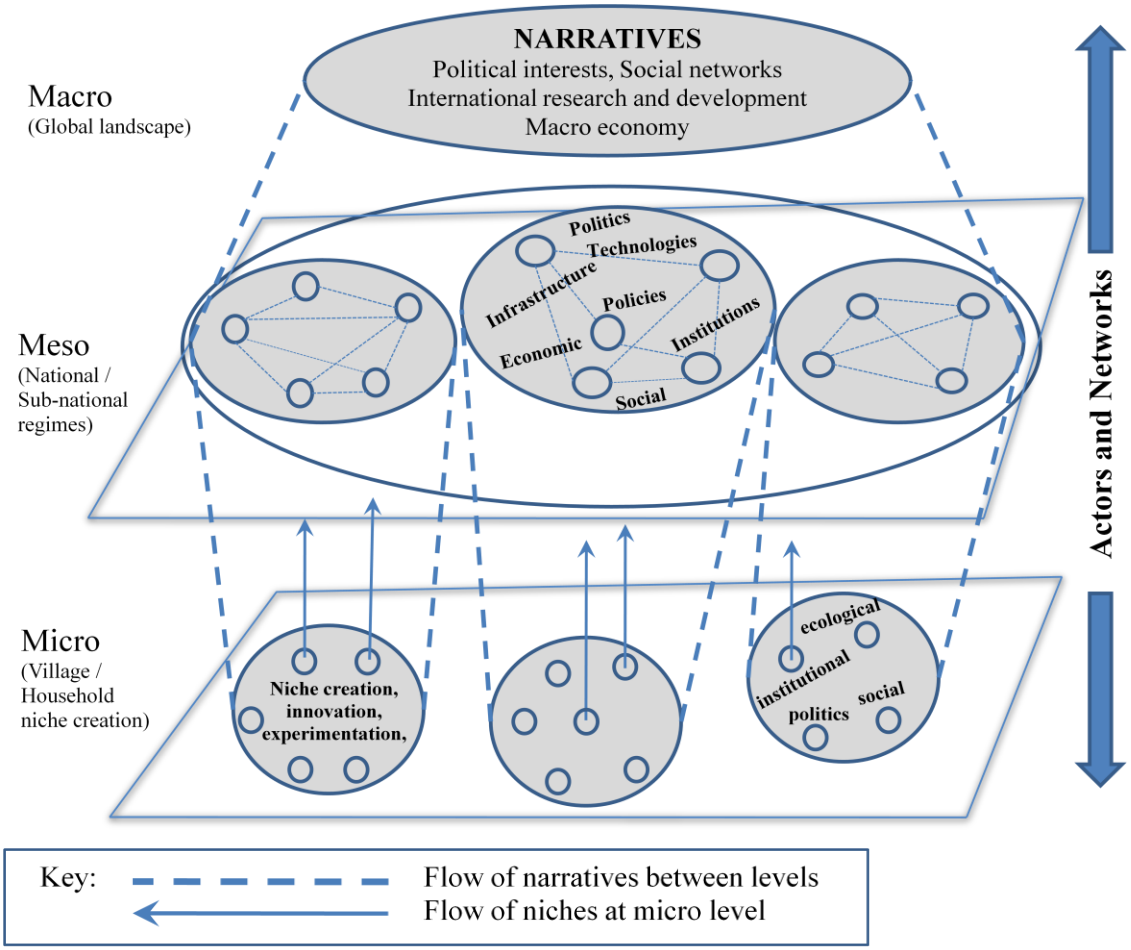

Figure 4: Conceptual diagram of the multi-level framework (adapted from Geels, 2002)

The focus of my research is on the dynamics of these interactions and how the three levels come together in a given locality through a specific technology-driven agricultural programme. The analysis centres on the interplay of the different narratives and actors within each level that may or may not be aligned to highlight the mismatches in terms of underlying intentions of policymakers and how the programme recipients understand, implement and accept the food security and agriculture programmes.

While not binding the research to the strictest definitions of the MLP, this hybrid use of the multi-level framework allows me to articulate the interactions between the individuals at the different levels and the impacts this may have on developing sustainable food security programming for smallholder farmers in Kenya. Bringing in components of the MLP allows a wider systemic perspective to be explored and

incorporates the view that technology is socially embedded and "emphasises co-evolution of technology and society" (Geels, 2005: 642).

Research design

In designing this research, I used a combination of historical and qualitative enquiry across the three levels identified in the previous section. The core qualitative methodology involved in-depth interviews and documentary analysis of policy processes at global and national levels. Detailed village-level case studies were used with a combination of participatory appraisal and ethnographic approaches. I used individual household-level case studies to explore how technologies are embedded within wider social and economic systems (Rip and Kemp, 1998). These case studies are complemented by quantitative data collected from existing household surveys. This allowed the case studies to be defined and sampling of households to be carried out.

The data provides information on the performance of the agricultural system at the local level (in terms of input delivery and uptake), as well as the impact this has had on household-level food security and socio-economic change. The research also provides an overview of the main narratives surrounding the use of improved agricultural inputs to address food security at different levels (global to local) to highlight the assumptions that are built into these narratives. In so doing, I was able to analyse how these narratives hinder or assist the ability of different actors within the levels to understand each other and the consequences this has on the programmes and actors.

Research questions and multi-level analysis

Based on the analytical analysis described above, the key question asked in this research is:

- How are the current Green Revolution narratives that are constructed in/for Africa affecting the design and implementation of input-support programmes for smallholder farmers in Kenya?

As I described above, the research was conducted at three levels (macro/meso/micro). These are highlighted in Table 1 with an overview of the related sub-questions:

Table 1: Overview of the multi-level research methodology

Level	Themes	Sub-questions	Research methods
Macro	Global environment	1. What is the geopolitical context that is influencing the narratives on a Green Revolution for Africa and how does this influence Kenya's policy process and approaches to food security programmes? • What are the key Green Revolution narratives currently being espoused by the international donors? • What are the key international conditions that may affect the delivery of input-support programmes?	- semi-structured interviews with key actors such as bilateral donors, multilateral agencies, and government departments - literature review - document tracking
Meso	Politics and policy processes	2. How has the global framing of the food security/productivity debate influenced approaches to and construction of inputs packages (consisting mostly of hybrid maize seed and inorganic fertiliser) to smallholder farmers in Kenya? • How has the national government and other key actors framed the input-support problem within Kenya?	- actor-network mapping - semi-structured interviews with key actors such as government (i.e., Ministries of Agriculture); local officials (i.e., district officials)
	Institutions, administration and delivery mechanisms	3. How do national and donor policies – and their associated framings – construct input-support programmes directed to smallholder farmers in rural Kenya? • What institutional and administration arrangements influence the style and form of input-support programmes? • What are the trade-offs and constraints faced by the staff who administer these programmes and how does this affect practices on the ground?	- actor-network mapping - document tracking - semi-structured interviews with key actors such as those mentioned above and including local NGOs and private sector groups
Micro	Social and power-relations	4. How are agricultural socio-technical systems constructed at the village level and maintained through local socio-economic processes? • What is the role of social networks in disseminating technical information and related technologies? • How are local agricultural problems and practices defined (and by whom) and how is this information embedded into input-support programmes?	- farm visits - focus group discussions - participatory workshops - participant observation - existing baseline data - interviews with key actors in the community, NGOs and private sector
Multi-level comparison		5. Contrasting two types of socio-technical systems focused on delivery of agricultural inputs, what are the outcomes in terms of the adoption and sustained use? • How does the design of input-support programmes affect the uptake and response of new technologies among the local community? • How do the delivery structures and the understanding of those delivering the programme affect the outcomes of the programmes vis-à-vis those who are the 'recipients'?	

Macro-level design – Asian and African Green Revolution(s)

The macro-level analysis focused on a historical overview of the Green Revolutions and Kenya's agrarian change from colonial times to the present day. The aim was to focus on the key narratives surrounding these historical events and to unravel what is meant by a Green Revolution today. It examines the social, institutional and political factors that put pressure on, and helped to develop, the Asian Green Revolution. The research shows how dominant actors and narratives helped to establish a regime based on a stable configuration of "institutions, techniques and artefacts, as well as rules, practices and networks that determine the 'normal' development and use of technologies" (Smith et al., 2005: 1493). The focus is on the agricultural technologies promoted at the time (such as inorganic fertiliser and hybrid seeds) and how these become ingrained in institutions (e.g., government and research institutions) and supported by individual actors. The concept of a regime is useful in both the macro- and meso-level analysis for three reasons.

First, regimes evolve over *time* and build on previous regimes (van der Ploeg et al., 2004). The research takes a time-scale approach to examine how the current African Green Revolution regime grew from the previous Asian one. It examines how a predetermined set of rules on national and supranational regulations become embedded when transposed from one setting (Asia) to another (Africa) and can directly, or indirectly, prescribe farming practices to the new locality based on the previous settings.

Second, the term regime implies a specific *trajectory* for ongoing research and development (van der Ploeg et al., 2004). Therefore, the research highlights how current dominant food security narratives are entrenching the use of certain technologies and are influencing present Green Revolution programming. In so doing, certain development trajectories are being set and other innovations, considered less relevant, remain undeveloped. This has major limitations for the creation of alternative pathways and innovation (Nelson and Winter, 1977).

Third, regimes at one level *link* different levels, actors and dimensions (i.e., social, technical and material) to regimes at another level (van der Ploeg et al., 2004).

Therefore, regimes allow for further exploration of the multi-level analysis (described earlier). They also examine how each of these levels affects the delivery of input-support programmes and highlight the links between local farm-level operations and decision-making systems at national and supra-national levels.

Meso-level design – Kenya's policy process

Following on from the macro-level analysis, the meso-level analysis focused on the current design of the African Green Revolution concept and Kenya's agriculture policy process at the national and sub-national levels. This analysis investigated how a particular technology-focused regime becomes embedded into Kenya's national policy processes and plays out at the local context. Key actors and networks were mapped and related narratives were used to investigate the ways in which different food security programmes have evolved. Through extensive interviews with national and international development actors, the analysis identifies the key issues framing the productivity debate, both globally and within Kenya. Key tools include actor-network mapping, document tracking and key informant interviews with representatives from government, donor organisations, the private sector and NGOs.

Informal interviews with a range of actors were used to understand the matrix of networks and narratives operating at the national level. Fifty-three semi-structured interviews were conducted between January and May 2010 in Nairobi for the policy process analysis (see Annex A for full list of interviewees). These included a series of interviews with national ministries, donor agencies, NGOs, national and international scientists, policy researchers and private sector seed and fertiliser companies operating in Kenya. The interviews covered a range of topics, including the Kenyan agricultural environment, food security, soil fertility management and improving access to inputs for smallholder farmers.

I drew extensively from my previous work at the MDG Centre[4] in Nairobi, where I worked as an Agriculture Policy Specialist and interacted with the Ministry of Agriculture and other key actors in food security in Kenya. Having spent five years

[4] The MDG Centre in Nairobi offers advisory services and policy support on the MDGs to national governments in the region and provides technical support to the Millennium Villages Project.

living in Kenya (2005–2011), I had established numerous contacts (including government, donors, private sector and NGOs), as well as collecting and analysing key documentation, and these were used to balance the qualitative interviews conducted during the research. I had come across many of these actors over the years and they were very open to meeting with me on numerous occasions to discuss my research.

Micro-level design – Case studies of two input-support programmes

The micro-level analysis was the main focus of the fieldwork. This involved a project-level analysis of two input-support programmes. The purpose was to map the socio-technical determinants at the local level and highlight the key social, economic, political and institutional factors that influence the outcome of input-support programmes. The micro-level case study analysis involved village-level data collected from Siaya (MVP) and Butere (NAAIAP). It involved gathering general background information about the social, institutional and political environment in these districts. This included an historical overview of input-support programmes operating in Western Kenya and data collection on the design and evolution of MVP and NAAIAP.

My national contacts were also helpful in negotiating district-level contacts in Siaya and especially in Butere where I had less knowledge and work experience. Gaining access to individuals within the two sites was facilitated by my contacts at the MDG Centre in Nairobi. I also had opportunities to work in the MVP village site in Siaya and interacted frequently with the community members. This experience facilitated my entry and introduction into the community. I was always mindful that my previous relationship with the MVP project might influence my decisions as an independent researcher. Therefore, throughout the process, I tried to remain unbiased in my data collection and used my previous knowledge only as a starting point in my research activities.

The micro-level fieldwork took place in Western Kenya over 15 months (April 2009 – June 2010) and consisted of 265 individual interviews and 11 focus group meetings. Semi-structured interviews with 72 households within the two research sites were used to understand the social structures/networks and cultural forces influencing fertiliser usage. A stratified sampling approach was used to choose the households for interviews

and to ensure representation of different households within each village (explained in the next section). A matrix was created to ensure representation across different wealth categories and equal representation of female-headed households. Each household was interviewed three times over the course of three planting seasons (April 2009–June 2010). Interviews were conducted within households and on farmers' plots to include direct observation about cropping techniques, planting styles and views on soil fertility. When possible, discussions included interactions with different household members to obtain a deeper understanding of the respondents' lives.

Of the 72 households interviewed, 12 were chosen as specific case studies for more detailed mapping of the local politics and institutions, and the cultural and social influences that affect adoption and use of fertilisers within their farming systems. The case studies were selected to represent particular types of households and to obtain a better understanding of the local socio-technical system surrounding fertiliser use through a more intensive interview format with additional family members. Focusing on a smaller sub-section of households for detailed case studies allowed the research to obtain a more nuanced and deeper understanding of some of the longstanding constraints to soil management and household food security.

In addition to the individual household interviews, nine focus group discussions were held at the village level with a mix of village elders, community leaders, women's organisations and past participants of the development programmes. Two additional focus group discussions were held with past NAAIAP programme recipients in neighbouring sub-locations in Butere. Focus groups were an important element of this research as they allowed the voices of a greater number of community members to be heard. They also brought forward an interesting diversity of views on community dynamics that were hard to obtain from individual interviews.

Another part of the research involved a deeper analysis of the surrounding socio-economic and institutional structures within which the farmers operate. Therefore, to understand the issues surrounding access to agricultural inputs in the area, a series of informal interviews were conducted with 18 private sector fertiliser retailers (agro-dealers) within six market locations surrounding the two research sites. Finally, to understanding the institutional and administrative structures surrounding the two input-

support systems, it was important to conduct a series of interviews with programme designers, implementers and evaluators from each system. A total of 19 semi-structured interviews were conducted with programme delivery personnel at the district, divisional and village levels, representing various levels of administration and delivery personnel associated with the two case studies. The following section goes into further detail on the research process for each of the case studies.

The research sites: Siaya and Butere Districts, Kenya

The process of selecting the exact sub-locations for the research had to take into consideration a number of factors. Most importantly, the sites had to have some similar farming practices and agro-ecological factors so that a comparison could be made between the two sites. Figure 5 shows the locations of Siaya and Butere Districts and the locations of the research sites.

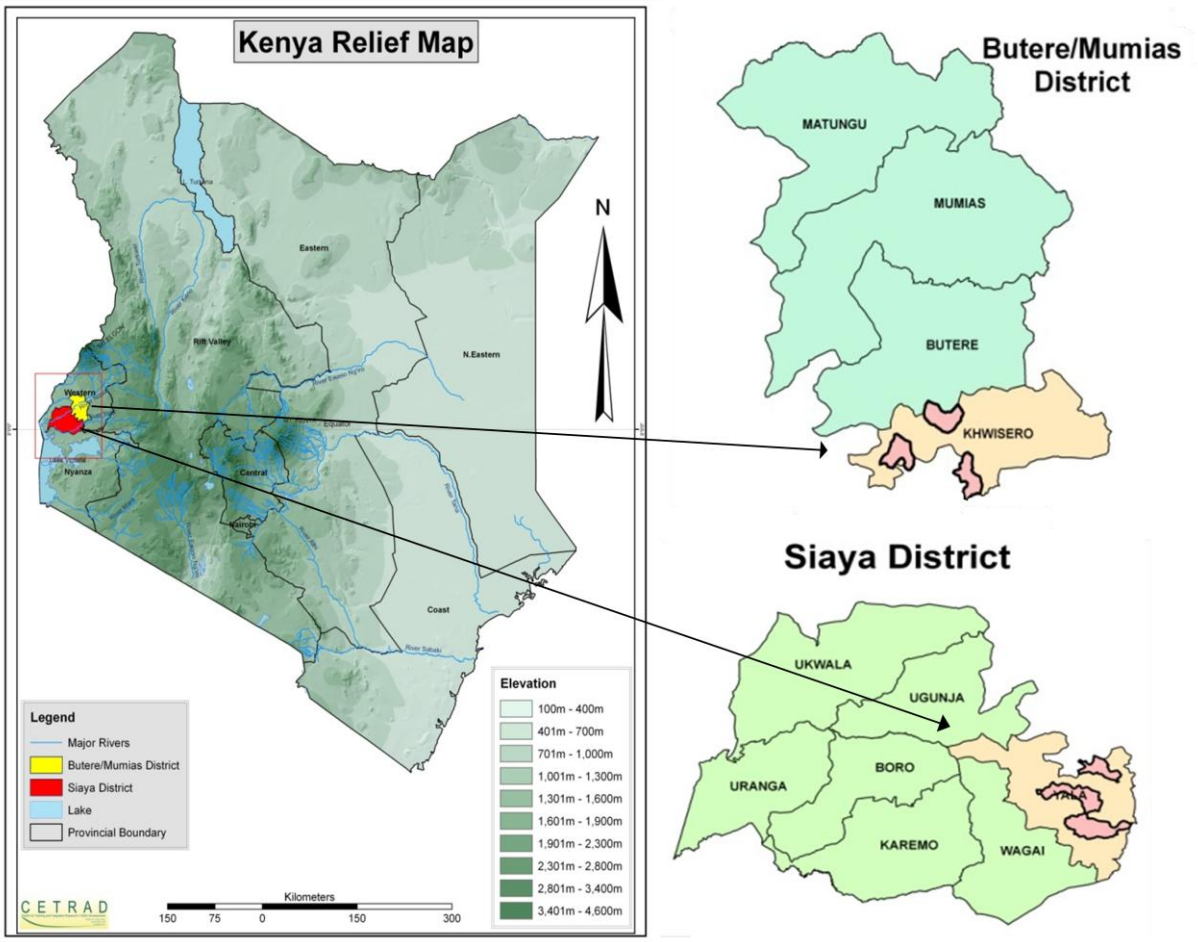

Figure 5: Location of Siaya and Butere Districts

The following section gives a brief description of the agro-ecological differences between the research sites and the process for selecting the individual sub-locations. Chapter 5 presents a more in-depth view of the two sites and explores the similarities and differences in terms of farming practices, demographics and other factors. Table 2 gives a short overview of the main characteristics of the two research sites.

Table 2: Comparison of the two research sites

Statistics	Butere	Siaya
District level[a]		
Altitude (metres above sea level)	1,240 – 1,641 metres	1,140 – 1,400 metres
Average rain fall (per year)	1,600 – 2,800 millimetres	800 – 1,600 millimetres
Soil type (general)	Shallow sandy loams	Ferrasols
Population density (persons per square kilometre)	661 (Khwisero Division)	410 (Yala Division)
Farm size (average for district)	1.42 hectares	1.05 hectares
Key food crops (district)	Maize, beans, sweet potatoes, cassava, sorghum, finger millet	Maize, sorghum, beans, cassava, sweet potatoes, vegetables
Main cash crops (district)	Sugarcane, sunflower, tea, coffee	Sugarcane, cotton, coffee
Income from agriculture	65 percent	60 percent
Research sites[b]		
Fertiliser usage before programme	91 percent	39 percent
Hiring labour (outside of household)	57 percent	55 percent
Average age (years) of household head (2009)	49.81 years	50.75 years
Education level of household head (average year of schooling)	7.3 years	6.4 years
Average household family size (number of persons living in the house)	5.91	5.6

Notes: (a) Data sources: Butere District Development Plan (GOK, 2002), Poverty Reduction Plan for Butere District (GOK, 2001a); Siaya District Development Plan (GOK, 2001b), and Siaya Strategic Plan (GOK, 2005). (b) Data from interviews with 72 households in the research sites in Butere and Siaya.

Siaya District - MVP

Siaya District is located in Nyanza Province, in Western Kenya. It is bordered by Butere-Mumias Districts to the northeast, Busia District to the north, Vihiga District to

the east, and Bondo and Kisumu Districts to the south and southeast respectively. Siaya is divided into seven administrative divisions, with a total population of roughly 500,000 (Mutuo et al., 2006). The landscape is characterised by undulating and rolling uplands with slopes that vary from 2 to 16 percent (Mango, 1999: 3). It has three major landforms (dissected uplands, moderate lowlands and swampland) with an altitude ranging from 1,140 to 1,400 metres above sea level (GOK, 2001b: 4) The district is classified as sub-humid tropics with an average annual rainfall of between 1,800 and 2,000 millimetres (Mango, 1999; GOK, 2001b; Millennium Villages Project, 2005).

The main economic activity is farming. Households practise intensive mixed farming systems, intercropping maize with beans, during two planting seasons. Most of the maize grown on farm is consumed within the household, while beans, groundnuts and some vegetables are grown as cash crops. While some larger-scale cash crops are produced (e.g., sugarcane, cotton and coffee), 98 percent of the land under cultivation is directed to food crops, including maize, sorghum, beans, cassava and sweet potatoes (GOK, 2001b: 9). However, even with this focus on food crops, Siaya remains a food-deficient district and an overall net importer of maize, which is brought in from surrounding areas and neighbouring Uganda (GOK, 2005).

Figure 6: Emaculate Otieno showing her maize crops, Siaya, May 2009

The MVP site is located in the northeast of Siaya, in Yala Division, which has relatively high altitude, rainfall and topography, and is considered a high potential area. Yala also has the highest population densities in the district with over 86,000 people and a density of 410 persons per square kilometre (GOK, 2001b: 7). Yala Division is divided administratively into three locations (Yala Township, Central Gem and East

Gem) and 19 smaller sub-locations. MVP covers parts of all three locations and operates in 11 sub-locations. To get an overall sense of the MVP, I chose one sub-location within each of the three locations, with sites at Sauri, Lihanda and Nyandiwa (Figure 7).

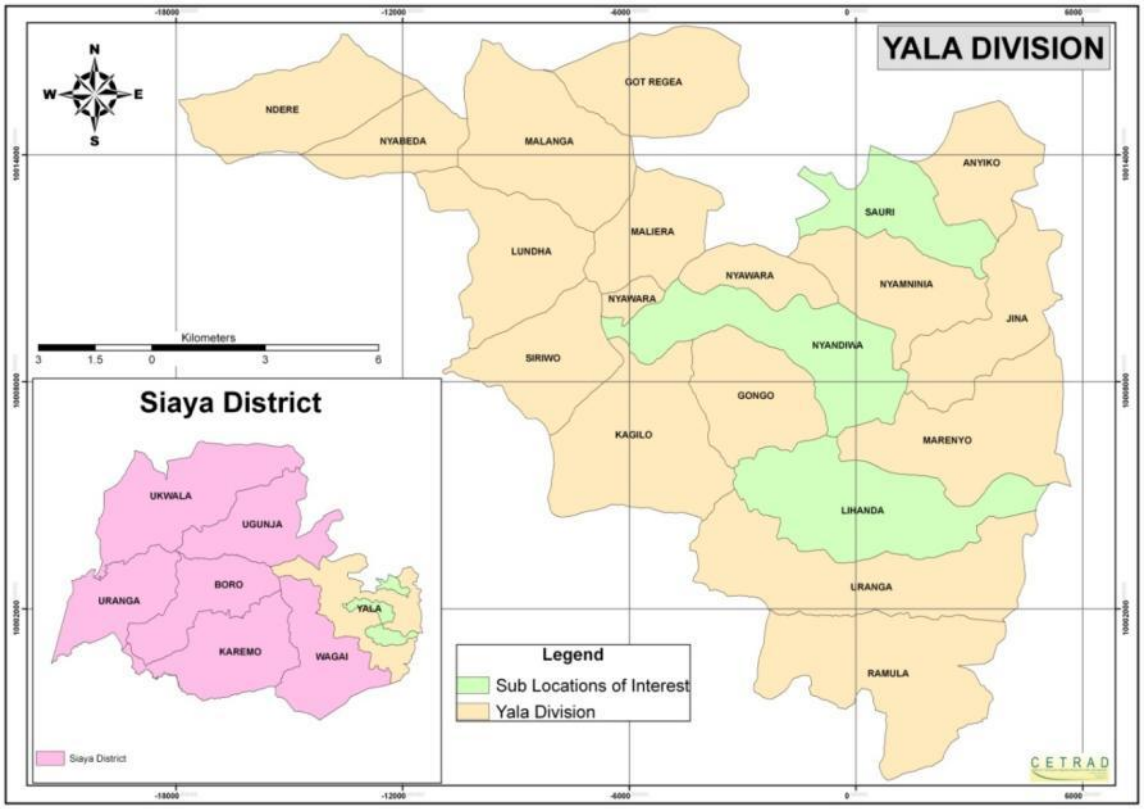

Figure 7: Yala Division and the three sub-locations (Lihanda, Nyandiwa, Sauri)

Within the three sub-locations, the soils vary slightly but are mostly clayey, reddish, deep and well drained (Millennium Villages Project, 2007). Throughout the research, I noted slight variations within the three MVP sites. Sauri sub-location is flatter and less rocky than the other two sites, with little variation in altitude range (households interviewed averaged 1430 metres above sea level, with little variation). Lihanda sub-location was markedly hillier and contained more rocky surfaces (averaging 1,450 m), with large exposed boulders rising throughout the hillsides. Nyandiwa had the most diverse landscape with both rolling hills and deep valleys (household range was the largest, ranging from 1,370 to 1,440 metres above sea level, with the average at 1,400 metres). According to the MVP, most of the soils in the area are derived from volcanic material and were once quite fertile but are now depleted of essential nutrients for plant growth as a result of continuous agricultural cultivation (Millennium Villages Project, 2005).

Butere District - NAAIAP

Butere District is one of eight districts in Kenya's Western Province, and is bordered by Bungoma and Busia Districts in the west, Siaya District in the south, Vihiga District in the east, and Kakamega and Mumias Districts in the north. In 2010, the population of Butere was approximately 574,000, which represents a 20 percent increase from the previous decade (GOK, 2001a, 2010a: 4). Butere has one of the highest population densities in Kenya with 546 persons per square kilometre (GOK, 2002: 7).

Butere's landscape is fairly flat with some slight variations in terrain, characterised by rolling hills and valleys interspersed with a few small streams. The district has a range of soil types, including fertile loamy soils in the northern part of the district that have contributed to the commercialisation of such crops as sugarcane, pulses and cereals. The mean average temperature for Butere is 29 degrees Celsius. Annual rainfall is between 1,600 and 2,900 millimetres per year, within a bi-modal rainfall distribution, resulting in two separate planting seasons (GOK, 2002: 6). The first planting season, often referred to as the *long rains*, occurs between February and June. The second planting season, or the s*hort rains*, occurs between August and November. In this region the long rains are considered much more stable and predictable.

Butere represents one of the 38 districts in Kenya that received inputs from the NAAIAP. I focused the research on Butere after significant evaluation of different locations and discussions with Ministry of Agriculture officials. Next, I organised a series of meetings with the Ministry of Agriculture staff in Nairobi and the District Agriculture Officer (DAO) in Butere to decide on which division to base the research. Through these consultations, I decided that Khwisero Division within Butere represented not only the closest site to the MVP, but more importantly, it shared the closest similarities of farming practices and agro-ecological features. This provided me with the foundation for a strong comparative study of two distinctive case studies, which shared many socio-technical elements.

Khwisero Division, in the southern part of the District, has the highest population density with 661 persons per square kilometre (GOK, 2002: 8). It has relatively poor soils consisting of mostly shallow sandy loams that have become highly eroded (GOK, 2002). Sugarcane is a major cash crop for Butere (GOK, 2002). However, Khwisero's poor soils have resulted in limited opportunities for commercialisation of cash crops. The major economic activity for most farmers in this division is subsistence maize and bean cultivation. The leading sources of income for the households tends to be casual labour in the sugarcane fields in neighbouring divisions to supplement their subsistence farming (Oiye et al., 2009: 1314).

Figure 8: A farmer sifting beans that she will sell in the local market, Butere, June 2009

Khwisero is the poorest division in the district due to a combination of poor soils, lack of staple cash crops, and a high population density, which has resulted in "heavy demarcation of land into small uneconomical units" (GOK, 2002: 22). The average farm size in Khwisero is 0.20 hectares per household. According to a recent survey by Oiye et al. (2009: 1314), households in Khwisero spend on average two-thirds of their total household income on buying food.

To determine the exact sub-locations for the research, I held a series of meetings with the Division Agricultural Extension Officer (DAEO) and three Agriculture Representatives (referred to as 'Farmer Reps')[5] working in Khwisero. Based on these consultations, I selected Doho, Emutsasa, and Khushiku sub-locations (Figure 9).

[5] The Agriculture Representatives (Farmer Reps) are local farmers enlisted by the government to help extension officers to implement NAAIAP. Their role is to help facilitate the programmes and to liaise between the farmers, the village elders and the government officials. Applicants hold the position for two years. It is an unpaid position although they receive stipends for each day they assist the Extension Officer with implementing the programme.

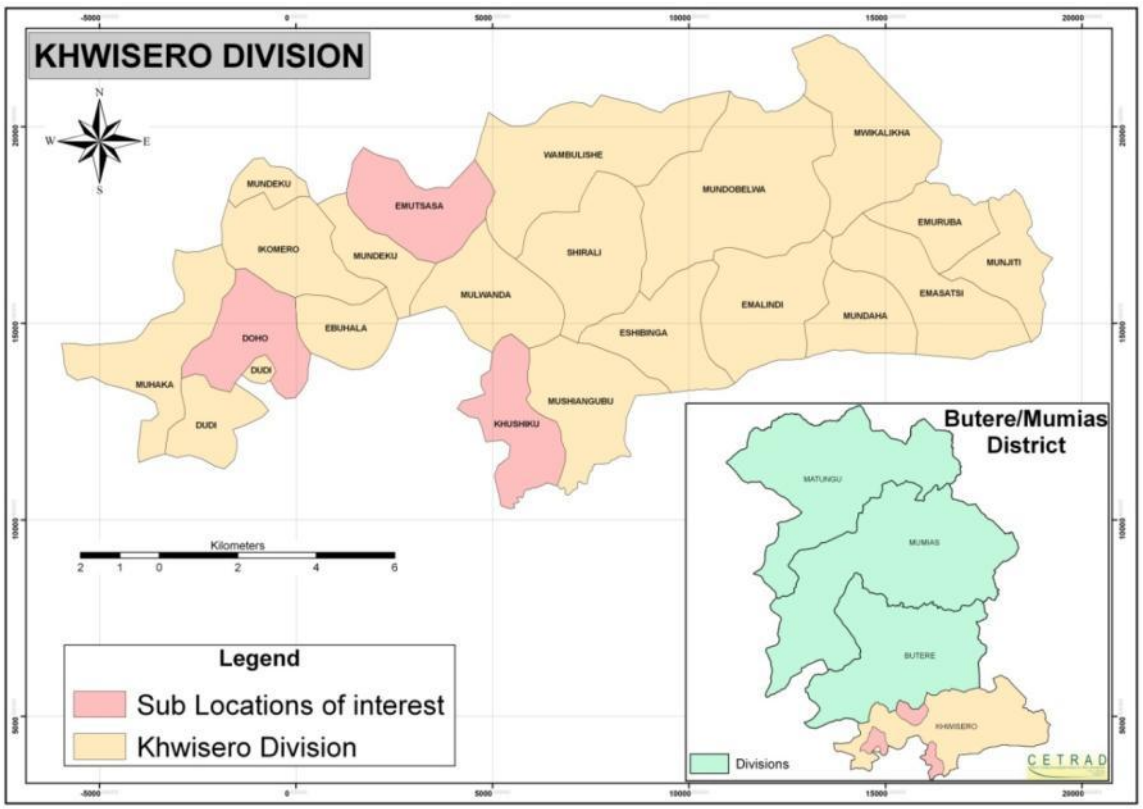

Figure 9: Khwisero Division and the three sub-locations (Doho, Emutsasa, Khushiku)

These sub-locations are the closest NAAIAP sites in proximity to the MVP sites and represent similar agro-ecological conditions and comparable planting styles. Of particular interest was Doho, which shares a physical border with the MVP project site and offers very interesting insights into local farmers' personal observations about the two programmes. During the research, I found that the three sub-locations had much more uniform terrain than those found in Siaya. For example, Khushiku consists of mainly hilly terrain and homesteads had little variation, with altitudes of 1,440 metres. Doho ranged between hilly and green plains, with homesteads ranging from 1,397 to 1,440 metres. Emutsasa was the least hilly of the sub locations, where homesteads are located at an average of 1,420 metres above sea level.

Selecting the households

I used a qualitative case study approach to delve deeper into the socio-technical realities of the people's lives and farming practices in my chosen research sites. This

uncovered textured information about the households in terms of their engagement with particular agricultural technologies (particularly seeds and fertilisers) and the different practices and choices that shape individual interactions. The 72 households (36 households from MVP and 36 from NAAIAP sites) were selected to describe the different narratives surrounding soil fertility management and the social system interactions with technology that exist at the household level. This number of households allowed me sufficient time to revisit each one on numerous occasions and to explore in detail the unique nuances that occur within particular socio-technical configurations at the household level.

Based on the hypothesis that social structures, power networks and local institutions have a bearing on farmers' interactions with technology, a sampling approach was designed to select a range of households within two axes: (i) wealth category and (ii) gender representation. For the wealth category, three income levels were chosen: 'Wealthier' (A); 'Middle' (B); and 'Poorer' (C) (see Table 3). The categorisation was based on previous socio-economic assessment conducted by MVP surveys, which collected data from a range of income indicators and assets. Using a gender axis allowed me to explore key gender dimensions surrounding the intersection of social and institutional factors, and how these might affect the ways in which a household interacts with a technology, based on different factors such as access to resources (e.g., land, labour, credit) and other social factors. I was aware that additional factors, such as education, age and size of land holding, could affect farmers' interactions with technology. Therefore, I ensured that the intensive case study approach enabled me to collect such data and reflect it in my findings.

Table 3: Overview of MVP households (HH)

MVP wealth category	Female-headed HH	Male-headed HH
Wealthier - A (upper quartile)	6	6
Middle - B (median quartile)	6	6
Poorer - C (lower quartile)	6	6
TOTAL	**18**	**18**

MVP had conducted an extensive baseline dataset based on wealth categories. I was able to access this data to randomly select 12 households per sub-location based on the chart below for a total of 36 households. I purposively sampled equal numbers and

equal ranks of households from these two axes as it allowed me to compare how different households, based on wealth and gender, interacted with the input package offered by the different programmes. This sampling methodology allowed me to relate my findings to the broad socio-technical patterns that are highlighted in the later case-study chapters. Other important characteristics, such as age, education levels, land sizes, remittances, and other factors were gathered and analysed through intensive interviews with each of the households.

The strata used to select all households were similar in format for the two research sites. However, household-level wealth category for the NAAIAP households was formulated slightly differently. While MVP had conducted extensive wealth category exercises prior to the start of the programme, the government official in NAAIAP had not. Instead, the programme administrators relied on recipient lists produced by the village elders and the Farmer Reps in each sub-location to determine who would receive the input packages. Therefore, in order to maintain the same wealth distributions, I conducted a general wealth category exercise in the three sub-locations based on the MVP exercise conducted in Siaya.

The key wealth category indicators included:

- type of house (thatched versus iron sheet roof);
- wage earning (off-farm and other income earning activities);
- number of assets (landholding size, number of livestock, other assets, e.g., bicycle, radio);
- remittances (children living and working in towns); and
- education level (of recipient and their children).

Focus group meetings at the sub-location level determined the household wealth categories. The focus groups included village elders, agriculture representatives, community representatives (including women's groups) and key resource persons (self-appointed) able to assist in this process. The wealth category process began with the focus group determining the appropriate indicators to classify a household as 'Wealthier' (A), 'Middle' (B), and 'Poorer' (C) categories, based on the MVP characteristics.

Once the analysis was completed, the NAAIAP recipients were grouped according to their relative wealth and the gender of the household head. Then 12 households were randomly selected from the wealth categories and gender sub-groupings using the stratified random sampling approach used for MVP. This approach was replicated in all three sub-locations to obtain a total of 36 NAAIAP households to interview.

While efforts were taken to purposively select an equal sampling of households based on wealth categories and gender representation, the final NAAIAP list required manual adjusting as some households identified as 'female-headed' were not, since their husbands were still present in the compound. This misrepresentation may have been a result of NAAIAP criteria that targeted female-headed households, resulting in households listed incorrectly in order to benefit from the programme. Vetting the names through the focus groups allowed some refinement of the list to achieve a balanced distribution and include true female-headed households. Even with this vetting, later interviews revealed that some households were not, in fact, female-headed. In the end, the research included 21 male- and 15 female-headed households, which allowed sufficient representation to make good comparisons between the two groups.

Ethical considerations

The case study analysis involved two ethnic groups (Luo in Siaya and Luhya in Butere) and interviews were conducted in the Luo (Dholuo), Luyah/Kisa and Kiswahili languages, depending on the household and location. I worked with one translator, Ezekiel Avedi, who spoke a variety of local languages. Avedi has extensive fieldwork experience in the area and has worked for five years as an enumerator and assistant researcher for MVP in Siaya and for The World Agroforestry Centre in the surrounding Butere area. His knowledge and ability to speak local languages proved to be a great asset in building relationships within the communities. All other interviews, including national-level interviews in Nairobi and programme-level interviews with staff and government officials in Siaya and Butere, were conducted in English.

During all these interviews, I was cognisant of the fact that I was asking personal information about household food security and garnering opinions on the programmes that were delivering the input packages. Therefore, at the start of each interview I explained the purpose of the research to ensure informants were comfortable with the topic and to ask their consent for participation. Each subsequent interview began with a recap of our previous discussions to ensure accuracy in how I had interpreted the previous interview. Participation was voluntary and interviewees were free to dictate the time, location and duration of our interactions. I also sought permission to record the discussions. A university student in Nairobi then transcribed the interviews.

At all times, I was mindful of the ethical data collection standards as outlined by Laws et al. (2003) to ensure no harm was done to the research participants. Therefore, while I did receive permission to use their names throughout the research, I used household-level identifier codes to document the responses. Most participants are presented in the thesis by wealth category, gender and location and pseudonyms are used when necessary. However, in the detailed household-level case studies, I requested permission to use their names and personal descriptions in writing their personal stories. Permission to use full names and organisations were sought in all interviews with programme staff and national-level participants. In the rare instances when persons requested to remain anonymous, I have not divulged their identities.

I was conscious that I must seek the cooperation of members of the village and district officials, informally and formally. I was able to do this by articulating the nature, intent and purpose of my research and what would be done with the results. I was aware that my connections with the MDG Centre raised questions of my affiliation with MVP in both research sites. This was difficult to avoid in the Siaya sites as every household had completed numerous MVP-led surveys over the past five years. However, I continued to state my independence prior to each interview. The situation in Butere was different. Once the communities heard I had been in Siaya, rumours circulated that I was sent by MVP to investigate possibilities of the programme expanding to Butere. These initial rumours caused confusion with the village elders and chiefs.[6] Understanding that these

[6] Village elders are the elected representative in the village, while the assistant chiefs and chiefs are appointed by the government to represent the administrative units of sub-location and location, respectively, on behalf of the government.

misconceptions could influence the data, I constantly re-emphasised that I was independent from MVP and outlined the purpose of the research. My ability to go back to each household three or four times over 15 months (April 2009–June 2010) allowed me to build a relationship with the households, and allowed for more in-depth discussions than would have been possible with a one-time visit. I tried to ensure that my interview style remained the same between the two sites and that my data could speak for itself without interpreting too much based on previous experience.

Reflexivity and positionality

As a 'Western' researcher operating in an African context, it is important to understand the issues of 'positionality', reflexivity, as well as the knowledge and power relations that exist within research processes (Marcus, 1994; Seale, 1999). I needed to be aware of my own position and interest and take account of the fact that knowledge becomes constructed by my interactions with the interviewees, including why I chose to ask some questions and ignore others that I felt were outside the scope of the research (Hertz, 1997). Therefore, in asking questions, I also had my own role to play in the co-construction of knowledge (Finlay, 2002).

Throughout this process, I was acutely aware of my ethnicity, educational and economic privilege and that I was considered an outsider. People placed me in certain categories (e.g., researcher, woman, or simply as *'muzungu'* a white foreigner), and negotiated their relationship with me on this basis. Therefore, I had to be cognisant of the power relations and politics within my own research process. While I may have lived in Kenya for five years and spent 15 months visiting the study sites, it was not enough time for me to begin to comprehend the lives of the people I was interviewing. Of critical importance was to be true to the interactions in that time and space (Sultana, 2007) and to present to the best of my ability, a small part of their stories and the knowledge I gained through my research. And of course, to understand that my perceptions of what is 'true' and 'important' is deeply rooted in my own experiences, ideologies and positionality (Bruner, 1986; Richardson, 1994). I was also mindful that the information being translated was reinterpreted by my translator's own expectations and beliefs. Therefore, I had to be diligent throughout the interview process to ensure adequate data collection and interpretation, to the best of my ability.

Challenges and further research emerging from the research

I experienced three main challenges in my village fieldwork. First, adequate recall of past events was an issue for some, mostly elderly, respondents. I addressed this issue by talking to additional family members who may have greater recollection of historical events, discussing the same events with local extension workers, and correlating the feedback with reports and surveys conducted by MVP and the government.

Second, most village-level interviews and focus groups were conducted in local languages. My translator could cope with a variety of languages and so allowed respondents to speak in their own language. Yet, it took time for him to learn how to translate and, at times, the responses were summaries of longer conversations. However, since we went back to each household numerous times during the research period, I was able to review the information with the respondents to ensure that the stories were acceptable to them.

Third, since I chose three sub-locations in Siaya and three in Butere, the distances between the households were quite far. This not only increased the time spent going from house to house, it also meant I had less time to get to know the wider community. However, I felt that having a diversity of locations for each site allowed me to test out many of my assumptions and avoid having the data influenced by one set of community or village-level characteristics that might not be representative of the area.

In addition, three priorities for further study also emerged from my research. First, due to my desire to focus the research, this was not a comprehensive look at all Green Revolution components but only a particular set of technologies (hybrid seed and fertiliser). I felt that these represented a key component of what I wished to accomplish through a socio-technical approach. However, these technologies alone are not the answer to food insecurity. Therefore, looking at the impact and possible interactions of additional technologies and related policies could be possible in further studies.

Second, I took a very specific slice of the two programmes. MVP has many other activities that go beyond input support and NAAIAP had a credit scheme, neither of which are addressed in this research. However, I took an early decision to focus exclusively on the input-support packages for both MVP and the NAAIAP so that I could compare 'like-for-like' and I did not go into details on other programmes offered by MVP or the Government of Kenya. Further research into the dynamics of alternative interventions offered by the two programmes (i.e. MVP's integrated approach, including other agriculture, irrigation and health-related interventions and NAAIAP's cereal banks and credit programmes) could add to this literature.

Third, I purposely selected a small sample size for this research so I could focus on in-depth household-level case studies. However, this sample size should not be seen as fully representative of the entire NAAIAP or MVP programme across different sites. The results are not indicative of the entire programme, but explain what happened in those locations within Siaya and Buture. By taking a small sample of households and using a qualitative approach, I was able to focus on the 'story' of the households and examine deeper issues than would have been possible with a wide-scale questionnaire. As a result, the outcomes do suggest interesting lessons that can be extrapolated to other areas. However, further research could look at multiple locations within the two programmes to explore results findings across a range of different programme sites.

Conclusion

This chapter has highlighted my hybrid conceptual framework that brings together components of multi-level socio-technical perspective and policy process analysis to create a more integrated perspective that takes into account multiple socio-economic, political and institutional factors that influence the interaction between technology and society. These aspects are conceptualised as a process of co-evolution, in which technology and society interact and change at multiple levels. The role of narratives, power structures and actor networks in shaping and influencing the current discussions around food insecurity and Green Revolution technologies are examined throughout the chapters. Together, the two case studies (MVP and NAAIAP) demonstrate how farmers' individualised socio-technical worlds shift and are altered as a result of their interaction with a particular technology and implementation processes. The household-

level interviews highlight how these technologies are embedded within wider systems of environmental and socio-economic change. Therefore, the essence of the study is on the construction of this change and how it is influenced by the unique characteristics of dynamic livelihoods and social worlds at multiple levels (local, national and global).

The next chapter starts at the global level and revisits the Green Revolution through a socio-technical lens to identify how certain political, economic and social factors affected the technical design, process and outcomes of agricultural input-support programmes. By examining the evolution of the Green Revolution, it shows how a productivity-technology fix narrative has become embedded in development policies and programmes to create a prevailing developmental regime – a set of rules and norms to address food insecurity in the developing world.

Chapter 3

Green Revolution(s) Revisited: Back to the future?

To understand the current food security and input-support programmes in Kenya, it is important to have a better understanding of past agricultural programming and a deeper appreciation of the policy processes that supported these programmes. This involves a macro-level analysis of the changing development landscape and the programmes implemented by donors and governments in an attempt to address food security over a given timeframe. This macro-level emphasis centres on the broader political, economic and institutional context that supports such specific elements as infrastructure, political culture, networks, communities, social values and the macro economy that directly affects agricultural systems and programmes. It also requires an understanding of the development narrative that evolved during this period. Such narratives are used to describe the underlying causes of food insecurity and outline the consequences if problems are not dealt with immediately. Mapping the global landscape is an important first step in demonstrating the influence of the macro level on the other levels.

One of the best-known narratives surrounding food insecurity was created during the Green Revolution that began in the mid-1960s. This narrative, which focused on the urgent need to address declining productivity to deal with an emerging food crisis in Asia, sparked a series of technological advancements in the fields of wheat and rice, and led to huge advances in agricultural production. Therefore, the chapter addresses two specific questions: (i) How has the global framing of the Green Revolution debate influenced approaches to the delivery of inputs to smallholder farmers? (ii) What geopolitical context is influencing the Green Revolution narratives for Africa today?

The chapter starts with a brief analysis of the origins and legacy of the Asian Green Revolution. It shows how agricultural technologies may have been the intervention tool used to address food insecurity and improve agricultural productivity, but that the success or failure of these interventions cannot be seen in isolation. Instead, these technologies must be viewed within the particular administrative, political, social and

delivery system that was prevalent in Asia at that time. This definition of the Green Revolution, expanded from the narrow 'technology focused' explanation, includes such factors as the geopolitical context, domestic realities, state interventions, markets and policy process as key components to aid understanding of the Asian model. By highlighting key socio-economic-policy elements of the Green Revolution, the section sheds light on the policy implications for the evolution of a Green Revolution regime for Africa and particularly for Kenya, as discussed later in Chapter 4.

The second part of the chapter focuses on agricultural development in Africa and presents an analysis of present thinking on a Green Revolution. It examines how the narratives of soil fertility improvement and a strong technology focus are being injected into current debates about African food insecurity. I use this present-day analysis to argue that certain limited narratives originating in the Asian Green Revolution have become the dominant storylines that are shaping current food security policies and programmes focused on smallholder farmers in Africa. Therefore, the attention on African agriculture has become biased towards technical 'fixes', with less attention on social and economic factors that affect the livelihoods of smallholder farmers.

The purpose is not to make the case for or against technologies or technical approaches, but to highlight the need to go beyond these narrow storylines and to broaden the scope to include the multitude of social, economic, political and institutional factors that shape food insecurity. I argue that Green Revolution programmes that address a multitude of factors will benefit from better uptake and sustained use of the technologies promoted.

The Asian Green Revolution reconsidered

Much has been written and debated about the Asian Green Revolution since it began in the mid-1960s. It started with a growing global food crisis, triggered by expanding populations and widespread crop failure in South Asia. As a result, many donors and national governments shifted their focus to increasing agricultural production to avert the predicted humanitarian crisis (Ruttan, 1984). The original Green Revolution sparked a radical change in food crop production and created breakthroughs in crop

breeding. This was first achieved for wheat in Mexico and later for rice in Asia. Both advances were coupled with the use of fertilisers to achieve remarkable increases in productivity (Barker et al., 1985; Conway, 1997).

There was a diverse set of drivers for the Asian Green Revolution during that period. Some historians claim that it was driven by the governments' desire for self-sufficiency in food grains, which was motivated by both the threat of famine and the volatility of world markets for grain (Djurfeldt et al., 2005a). However, many critics believed that the food crisis was not the only driver. Alternative narratives included Cold War issues, such as preventing the 'population bomb' (Ehrlich, 1968), ecological disaster (Borgstrom, 1973), geopolitics (Perkins, 1997) or communist insurgence (Richards, 2004; Djurfeldt et al., 2005a). The real drivers sit somewhere in the middle. As Shiva (1991) states, this period of history is of great significance, not only because it represents the advancement of technology, but also because it signifies how science and politics became "wedded together in the very inception of the Green Revolution" (Shiva, 1991: 52). These dominant narratives and prevailing structures have shaped the way development practitioners and national governments have created programmes within the continuing Green Revolution.

The Green Revolution model has often been narrowly couched as a set of technology packages that were delivered mostly to Asia and Latin America in the 1960s to increase agricultural productivity (Djurfeldt et al., 2005a). However, the Green Revolution was much broader and included a complex blend of technical, political and economic factors that existed in specific locations at that given time. Policymakers and scientists not only championed the spread of high-yielding varieties of rice and wheat, coupled with inorganic fertiliser, but also pushed for crop management practices that would allow these varieties to achieve their full potential. Other factors were also emphasised, including enabling policies, irrigation schemes, mechanisation, seed production, better infrastructure and stronger national research systems (Djurfeldt et al., 2005b).

While the main Green Revolution technologies (improved seed, fertilisers, irrigation and mechanisation) have received the majority of the attention, much less notice has been given to the unique administrative and programming structures within the governments and the donor community that dominated development thinking during

that time (Djurfeldt et al., 2005a). The early period of the Green Revolution can also be categorised as highly state-directed, when most Asian governments controlled many aspects of the agricultural supply chain and governments created input subsidy programmes to promote the use of the new technologies and increase agricultural productivity (Hossain and Singh, 2000). The state took on monopolistic roles throughout the entire value chain, from procurement and distribution of fertiliser by parastatal entities, through fertiliser subsidy programmes, to the setting of prices of commodities (Djurfeldt and Jirström, 2005).

The strong political commitment to the Green Revolution is exemplified by the experiences of India at that time. India implemented a blend of rural development interventions that consisted of large public investments and policy interventions to provide incentives for the adoption of new agricultural technologies. Throughout this time, government investment in rural areas increased fivefold, going up by 13 percent per year during the 1970s (Fan et al., 1999: 7). According to Johnson et al. (2003: 4):

> *The level of investments of this magnitude was a clear sign of the broad political commitment, at both the federal and state government level, to accelerate agricultural income growth in rural areas.*

Millstone et al. (2009) highlight, however, that while there were successes, even within India there are great differences in the outcome of these programmes. Green Revolution technologies amplified prevailing inequalities in some regions, while having different and more beneficial results in others. By contrasting results with the same technology within different parts of Asia, Millstone et al. (2009: 9) illustrate:

> *...the crucial influence of the socio-economic context into which technologies are introduced in determining the character and distribution of impacts. Inappropriate technologies can amplify social and economic inequalities rather than diminish them, and aggravate rather than diminish poverty.*

Therefore, technology-laden programmes are influenced heavily by a multitude of exogenous factors, including social, economic, political and institutional, that ultimately affect the outcome of the programme and the sustained use of the technologies by the recipients. While developing country governments were focusing

on large public investment projects and control of the rural economy, international donors were revisiting their role in agriculture and rural development.

Evolving global perspectives

Prior to the Green Revolution, many development programmes were implemented under the banner of 'community development'. This included economic and political objectives to improve the well-being of rural people, yet "without revolutionary changes in the existing political and economic order" (Holdcraft, 1978: 14). By the start of the Green Revolution, with the growing concerns over the global food crisis, international donors shifted their attention to agricultural production (Ruttan, 1984).

During this time, development practitioners' focus on agriculture and rural development began to widen to include a multitude of related sectors, including finance and infrastructure (Cohen, 1980). This belief in interconnectedness gave rise to a 'systems analysis' perspective that began to view rural development in a broader perspective that included an emphasis on the rural poor (Armor et al., 1979). This focus was reflected strongly in the speech by the then World Bank President, Robert McNamara, to the Board of Governors in Nairobi, where he called for rapid smallholder development that focused on increased productivity while simultaneously addressing the inequalities that existed in rural areas (McNamara, 1973).

In line with this thinking, development approaches began to regard the complementarities between different sectors within rural areas. By the 1970s, programmes became more comprehensive or integrated (Ruttan, 1984). Programmes began to place greater emphasis on equity in the distribution of wealth between urban and rural areas and between economic and social classes within rural areas (Rondinelli, 1979; Ruttan, 1984). This resulted in a shift in rural development programme focus from the mobilisation of community resources to the delivery of programme inputs and services through a 'package of technologies' (Holmén, 2003).

One of the earliest and most influential donor-led programmes during this time was the Comilla Project in East Pakistan (Bangladesh) created in response to the 1966 Indian famine. It aimed to address production constraints and to coordinate rural services

(Raper, 1970; Choldin, 1972). At the centre was a package of reinforcing activities taking place in a particular area to improve smallholder farmer productivity and promote more effective support for agricultural development (Cohen, 1987). The success of the Comilla Project rapidly made it a model for other donors' rural programmes.

Yet, even with these early successes, Rondinelli (1979: 390) argued that these strategies were done:

> *...without a clear understanding of the ways in which poverty might be alleviated and rural economies stimulated, and without the political and administrative commitment to make the drastic changes in economic structure which were needed to implement these policies.*

Therefore, while early results of large-scale technology packages were achieved for numerous agriculture programmes, many others were unable to address the underlying problems of rural poverty, which lay more with the weak administrative capacity of developing countries and the lack of political commitment to make a substantive change. The next section touches briefly on some of the mixed results of the Green Revolution.

Lasting effects of the Asian Green Revolution

Overall, there were large increases in agricultural productivity with new technological advancements in many developing countries. Between the early 1960s and mid-1980s, the production of food doubled, the number of rural poor were reduced, and the real prices of the main cereal crops fell considerably (Conway, 1997; Wood et al., 2000). Proponents considered the Green Revolution a success and Malthusian predictions of catastrophic famines caused by increasing population growth did not take effect.

However, these successes were not spread evenly across regions and within crops (Evenson and Gollin, 2003). Critics argued that the results were not equitable and that the wealthier portion of the population absorbed many of the technologies (Conway, 1997). They suggested that failing to tackle the complex power relations within communities and the overarching political factors that hamper the effective delivery of

input programmes allowed the elites and better off to capture the benefits. Therefore, the links with sustained food security for smallholder farmers were less evident and more difficult to establish. In addition, women were poorly integrated, with less attention given to their needs and women farmers were often bypassed completely (FAO, 1997). Other critics argued that the Green Revolution was plagued with environmental concerns about the loss of biodiversity, the increased use of pesticides and other chemical inputs and the focus on monocultures and grain crops (Shiva, 1993).

By the early 1980s, the tide began to turn and the amount of development assistance to agriculture began to wane. According to the Organisation for Economic Cooperation and Development (OECD, 2010: 3), aid to agriculture fell from a 17 percent share in the early 1980s to six percent at the end of the 1990s. This era also saw the introduction of the Structural Adjustment Programmes (SAP). Promoted by the World Bank and the International Monetary Fund, SAP advocated that national governments reduce controls on their agricultural production and marketing and provide a more open enabling environment for private sector participation. The result was a reduction in overall funding for agriculture in both donor and government allocation.

There were many reasons for this decline. Some were linked to difficulties in managing the complexity and risk of agricultural programmes. Others focused on the lack of success in obtaining and sustaining results in certain regions, especially in Africa. Ultimately, all these factors led to a loss of appetite to fund large, complex and expensive programmes, and to increased wariness of heavy state involvement in the agriculture sector. The perception that the Green Revolution (the model and the technologies) were not applicable to Africa began to take hold.

Africa and a new Green Revolution

While the original Green Revolution was intended to be a global phenomenon, it did not generate significant or lasting success in Africa. As mentioned, the Asian Green Revolution concentrated on wheat and rice, not on the traditional food security crops grown in Africa, which include millet, cowpea, sorghum and cassava. These African staples received less attention and less funding for crop improvement. Some

improvements were made on maize during this time, such as the hybrid maize grown on commercial farms in Zimbabwe (Eicher, 1995) and Kenya (Hassan and Karanja, 1997; De Groote et al., 2005). Yet, in comparison, maize still garnered comparably less attention than rice and wheat.

In Kenya, there was some success from 1965 to the 1980s though national maize production campaigns that focused on research, seed, maize marketing, pricing and credit programmes. However, even these successes were not sustained. According to Hassan and Karanja (1997: 90) these programmes:

> *... collapsed in the 1980s, as severe economic pressure weakened public financial support for research, extension and credit.*

Some critics contend that the research conducted for the Asian Green Revolution was not well implemented within the African context. For example, a study by Evenson and Gollin (2003) states that while researchers, governments and donors worked together to adapt improved varieties to the Asian context, the same could not be said in Africa. They state:

> *In the 1960s and 1970s, national and international programs may have sought to "short-cut" the varietal improvement process in Sub-Saharan Africa by introducing unsuitable varieties from Asia and Latin America, rather than engaging in the time-consuming work of identifying locally adapted germplasm and using it as the basis for breeding new varieties* (Evenson and Gollin, 2003: 758).

Evenson and Gollin (2003) argue that these short cuts in Africa contributed to very low productivity increases with the improved Green Revolution varieties in Africa. The end result was that production increases in Africa during the first Green Revolution were due more to the result of expanding the area under cultivation rather than improving productivity (Evenson and Gollin, 2003).

Another difference is the low levels of irrigation and rural population density in Africa compared with Asia. While Asia has vast areas under irrigation, African smallholder farmers depend mostly on rain-fed agriculture with very limited access to irrigation and within a multitude of agro-ecological climates (Harsch, 1998; Johnson et al., 2003).

The risk of crop failure is much higher for farmers dependent on rainfall than for those who can depend on irrigation systems. Sparse rural densities mean that rural labour markets are weaker, resulting in "higher per capital costs for investing in and maintaining basic rural infrastructure and services" (Johnson et al., 2003: 7). Therefore, Africa's low rural population densities caused a lack of investment in rural areas, resulting in poor transport and communication infrastructure (Dorward et al., 2004a). The high per capita costs of improving and maintaining rural infrastructure also affected the development of adequate agricultural markets for smallholder farmers. Lack of markets severely limits farmers' access to the inputs they need to improve their productivity and provide outlets to sell their produce (Spencer, 1994; Johnson et al., 2003; Dorward et al., 2004b).

In addition to the constraints of labour and markets, there were political and economic variations between the two continents. According to Eicher (1995: 806), the economic policy environment in Africa has been less favourable towards agricultural development for smallholder farmers versus the policies that were put in place in Asia. Most African governments had not made the same commitment to agricultural growth and rural poverty reduction that India's government made in the 1960s (Johnson et al., 2003: 8). As a result, national governments' budgetary allocations and investment in agriculture and the rural sector has remained lower than investments made by Asian governments at that time.

Refocusing on food security and agricultural productivity in Africa

As the previous section highlighted, the overall funding directed to rural development and agriculture started to diminish in the mid-1980s. This decrease had a direct effect on Africa, leading to under-investment in African agriculture. The long-term effects of this lack of attention on a continent where roughly 60 percent of all households depend on agriculture for their livelihoods are now apparent (FAO, 2008: 30). Nearly 30 percent of the population in Africa is undernourished, with child malnutrition getting worse rather than better, although large variations occur between countries (FAO, 2011: 66). While Asia can demonstrate success in its increased productivity, Africa is the only region in the world experiencing declining food production per capita (FAO,

2004b) and stagnant cereal yield trends (Figure 10). Rising food prices have pushed even more households into poverty and created a pervasive and deepening food crisis.

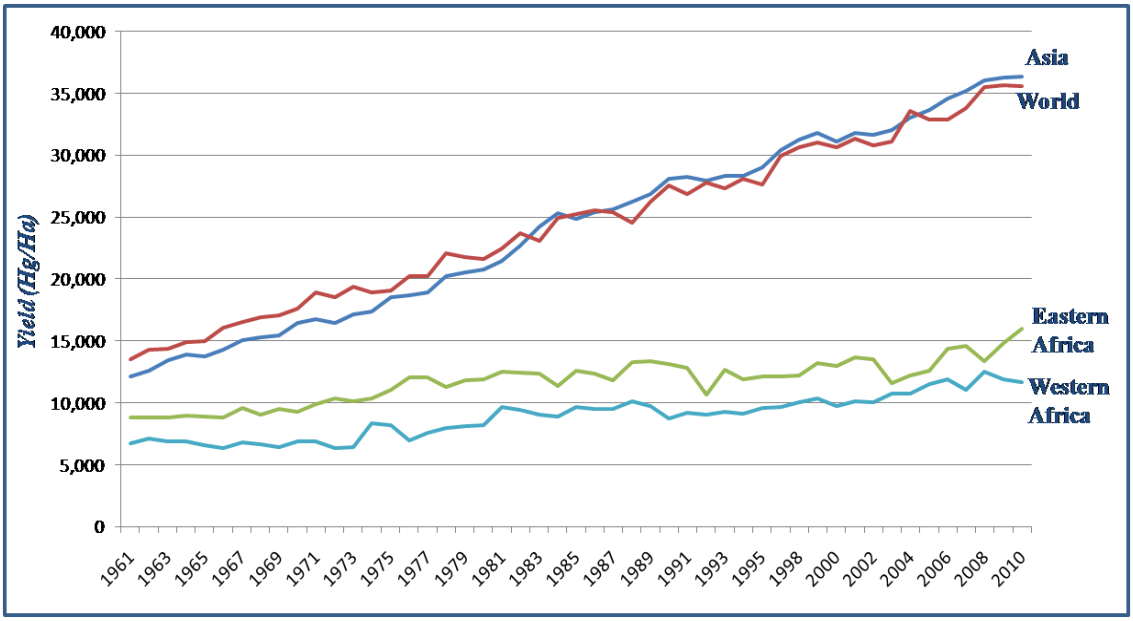

Figure 10: Cereal yield trends (Source: FAOSTAT data, 2012)

While progress has occurred in some parts of Africa, other parts have experienced deepening food insecurity and little improvement in productivity (Wiggins and Leturque, 2010). These growing disparities have prompted a marked shift in today's development debate, resulting in increased attention on improving African agriculture. Many countries have begun to refocus on agriculture as the 'engine of growth' for their economies. This renewed focus is leading to discussion on what exactly constitutes a 'Green Revolution for Africa' and what must be different this time to fit the African context. The re-emerging narrative states that if Africa is to overcome its worsening food security crisis, it will have to focus on agricultural productivity. At the same time, there is increased attention on the need to focus on smallholders, leading to the recognition that a new, more equitable and sustainable African Green Revolution is needed, one that is able to close the gap between scientists' priorities and the needs of food-insecure farmers to attain concrete results and sustained benefits.

National governments have also changed their stance from seeing the state as 'implementers' of projects to one of 'facilitators', bringing new partners onto the stage. Such initiatives as the Comprehensive Africa Agriculture Development Programme

(CAADP), a programme of the New Partnership for Africa's Development (NEPAD) of the African Union, offers a framework for partnership and policy renewal in African agriculture. As well, national-level funds directed to agriculture have slowly begun to increase, as per the Maputo Declaration, with signatories agreeing to increase spending on agriculture and rural development to 10 percent of national budgets. While many countries have yet to meet this target, they have attempted to increase agriculture's share.

The Abuja Declaration on Fertilizer for an African Green Revolution, which came out of the Africa Fertilizer Summit in June 2006, was another event that galvanised support for agriculture.[7] The summit aimed to put soil fertility and fertiliser usage firmly on the agenda of African countries. In support of this emerging narrative, the African Union declared Africa is "trapped in a fertilizer crisis" (African Union, 2006: 1) and urged African leaders:

> *...to show their strong and unanimous commitment to achieving the African Green Revolution by taking immediate actions to solve Africa's fertilizer crisis* (African Union, 2006: 1).

The AU urged African countries to increase usage rates from an average of eight kilograms per hectare to at least 50 kilograms per hectare by 2015 (African Union, 2006: 2).

This section demonstrates that the emerging Green Revolution narrative has re-surfaced, based on a narrow 'productivity-technology fix' paradigm that has significant elements of the earlier Asian Green revolution (Thompson and Scoones, 2009). This has created a particular vision for Africa that has a predominant focus on soils and such agricultural technologies as improved seeds and fertiliser. This increasingly limited view of technology as the principal means of addressing food insecurity in Africa has led to various policy decisions focused on the delivery of technology to the food insecure. The following section touches on the increasing debate on subsidies as a delivery mechanism of agricultural technologies for smallholder farmers in Africa.

[7] See *Abuja Declaration on Fertilizer for African Green Revolution* http://www.nepad.org/foodsecurity/knowledge/doc/1815/abuja-declaration-fertilizer-african-green-revolution.

The subsidy debate

The rise of global food prices in early 2008 and increasing food insecurity in parts of the world has reopened the debate on the use of subsidies, particularly what the World Bank has termed 'smart subsidies'.[8] These are based on delivery of agricultural inputs, such as hybrid seed and inorganic fertiliser, through various input-support programmes (Dorward et al., 2008; Poulton and Dorward, 2008). Interest in subsidy programmes has been revived in many African countries, including Ghana, Kenya, Malawi, Mali, Senegal, Tanzania and Zambia (Minde et al., 2008; Dorward, 2009; Baltzer and Hansen, 2011). Many of these have been based on recent successes with Malawi's national Agricultural Input Subsidy Programme (AISP).[9] The AISP has sparked debate on the impacts and benefits of subsidy programmes but is cited increasingly as a good example by other African countries wanting to model their own subsidy programmes (Chirwa et al., 2006; Crawford et al., 2006; cf. Chinsinga, 2007; Denning et al., 2009; Dorward and Chirwa, 2009; Minot and Benson, 2009; Poulton, 2009).

For those promoting the use of subsidies, the rationale stems mostly from the belief that farmers do not use inputs because the prices are too high. Therefore, input subsidies are viewed as a method to keep prices low and as an "aid in accelerating the learning process and thereby promoting its use" (IFDC, 2003: 15). Once the farmers have experienced the value of these inputs and begun to use them regularly, then the subsidy would no longer be required. However, Dorward (2009: 13) states that fertilisers have already been promoted widely in Africa and that it is "no longer the case that most farmers are unaware of fertilisers' benefits". The main constraint is not knowledge but *access* to the technologies. It is the farmers' ability to use the fertilisers effectively and efficiently that is more variable, and therefore "input subsidy programmes continue to

[8] Smart subsidies are often referred to as market-based targeted input-support programmes that use private sector dealers for input distribution and that have a clear exist strategy to control the overall cost of the programme.

[9] The Malawi Agricultural Input Subsidy Programme began in 2005/06 with maize seed and inorganic fertiliser subsidies (it has since then increased to other crops). The subsidies were distributed to qualifying households through a voucher programme, in which farmers would redeem the vouchers at selected agro-dealer shops. The vouchers subsidised the cost of inputs to a predetermined value (initially pegged at two thirds of the price of a 50 kilogram bag of NPK fertiliser) and farmers paid a 'top-up' to the agro-dealers (i.e., US$7.80) to receive the inputs (Dorward and Chirwa, 2009; quoted in Poulton 2009: 2).

have a potential role in helping farmers to learn from experience" (Dorward, 2009: 13). Yet, the key is to ensure the appropriate fertilisers and crop varieties are available at the right time, and are tied to improved extension services and soil and water management training. The importance of timing and having appropriate technologies for the given context are examined in the case studies in Chapters 6 and 7.

Another common reason for promoting subsidies is the argument that farmers often have difficulty obtaining credit. Farmers often lack finance to purchase inputs and subsidies can be used to compensate for this lack of credit. Therefore, subsidised credit is often used as a method to help farmers purchase inputs and increase their productivity (Dorward et al., 2004b; Djurfeldt et al., 2005b; Dorward, 2009). However, there are several difficulties in providing subsidised credit to farmers on a seasonal basis. For example, socio-economic factors, such as elite capture of the credit or low repayment rates from borrowers, can diminish the results (Chambers, 1978; Omamo and Mose, 2001; Liverpool and Winter-Nelson, 2010). However, a review of an agricultural credit scheme in Western Kenya, called the Sustainable Community-Based Input Credit Scheme (SCOBICS), offers some interesting conclusions (Poulton et al., 2004). The scheme showed that credit programmes could be:

> *...fully commercially viable only if borrower groups assume greater responsibility for loan collection and repayment than is the case under current microfinance models* (Poulton et al., 2004: 1).

Therefore, greater understanding of the social dimension, including participation and ownership by recipients, is an important factor behind the success of such programmes.

Other political factors, such as the national or local political structures and interests, can have an effect on the efficacy of programmes. Subsidies often involve a high amount of transferred capital and can lead to a large degree of rent seeking, or political interference, from certain actors interested in gaining unfairly from the subsidies (Dorward, 2009: 28). Therefore, there is a danger that governments may use these subsidies as patronage tools to garner political support (Bates, 1981; Chinsinga,

2007).[10] Administering subsidies on agricultural inputs can be difficult and ineffective due to delays in delivery of the inputs, delays in payments to suppliers and lack of capacity of the government to adequately monitor or appropriately manage different parts of the process.

Dorward (2009) highlights a political economic paradox, stating that stable, continuing and longer-term subsidies are needed for successful development of the supply chain and to improve the lives of the rural poor, yet, if subsidies continue for long periods of time, there is greater risk of them becoming politically entrenched and hijacked for political gain. There is an additional risk that long-running input support programmes can become expensive, resulting in a financial drain on limited government resources. Dorward (2009: 45) goes on to explain:

> *Input subsidies have played an important role in successful agricultural development in the past, offering major potential gain when effectively applied to overcome market failures constraining growth in poor rural areas, but also carrying substantial risks of costly, ineffective and inappropriate design and implementation using large amounts of scarce government and national resources for little gain.*

In addition to political and administrative factors, critics assert that local and national input markets can be adversely affected by subsidies (Gregory and Bumb, 2006). They contend that subsidies distort the proper functioning of markets and inhibit the growth of the private sector in delivering these technologies (IFDC, 2003; Mason and Ricker-Gilbert, 2012). This lack of institution building can be detrimental to long-term sustainability, since the removal of subsidies can result in farmers discontinuing use of the technology, as the structures (e.g., markets and infrastructure) have not been developed sufficiently to facilitate long-term use.

Proponents point out that subsidies can promote rapid growth in fertiliser use and agricultural productivity. However, opponents argue that recipients become dependent on subsidies for low-cost inputs, resulting in social and political pressures on

[10] According to Chinsinga (2007), the origins of the Malawi fertiliser subsidy programme originate from the Malawi national election in May 2004, in which the incoming president, Mutharika, and the other candidates ran their campaigns based on promises for input support to the Malawian smallholder farmers. The recurring droughts and increasing hunger in the country had "turned food security into a fierce battle ground both for parties in government and outside government" (Chinsinga, 2007: 6).

governments from farmers and input suppliers to continue the programmes, even when the subsidy may no longer be necessary (Banful, 2011; Mason and Ricker-Gilbert, 2012). This long-term continuation of subsidies can become a drain on government budgets and the costs associated with maintaining them puts into question whether it is the most cost-effective way of improving agricultural productivity (Ariga et al., 2009: 48). Yanggen et al. (1998: iv) argue:

> *...unless subsidies are accompanied by a clear program to rectify the underlying problems they are compensating for (e.g., inefficient markets, poor infrastructure) their demands on the budget grow rapidly, reducing the ability of government to make other agricultural investments.*

While input subsidies are becoming the preferred solution for the delivery of new technologies for boosting production, the debate continues about the appropriateness of subsidies, and the wider social, political and economic dimensions. These issues are examined in more detail within the context of the two case studies in Chapters 6 and 7.

Conclusion

This chapter presents a macro-level examination of how a regime, such as the Asian Green Revolution, became a stable configuration of institutions, processes, technologies and supporting policies that determined the trajectory of development programming to address food insecurity. It illustrates how the main agricultural technologies promoted at the time (i.e., inorganic fertiliser and hybrid seeds) have become engrained in institutions and supported by actors, so maintaining their prominence within the current system. Evolution over time shows how the Green Revolution emerged to become a dominant regime in Asia and how that regime, along with its supporting narratives on food security, is being incorporated into current debates on African agriculture. The trajectory of current development thinking demonstrates how these narratives are entrenching the use of certain technologies and influencing present Green Revolution programming. In so doing, certain development trajectories are being set and other innovations, considered less relevant, are becoming under-utilised. This has major limitations for the creation of alternative pathways and innovations. Despite much talk about the need to take into account the complexities of the African continent, the existing narratives from the previous Green Revolution in

Asia are being used to justify the creation of a specific regime, with a technology focus, as the major path for Africa.

The Green Revolution regime is still evolving in Africa and it remains to be seen whether national governments and international aid agencies will learn the lessons from the past, adapting flexibly to local contexts. Flexibility will allow development planners to offer a multitude of technology options to fit the needs of the diverse livelihoods and regions within Africa. Dennis Rondinelli's (1979: 415) astute observation from more than 30 years ago still holds true today:

> *Technology is merely a means to an end; in most cases even sophisticated, proven technologies will be unable to stimulate growth or alleviate poverty if a developing nation cannot mobilize political commitment, break institutional barriers to economic participation, and structure administrative agencies in such a way as to serve rural beneficiaries.*

Ultimately, examining the Green Revolutions past and present through a wider socio-technical, political and economic lens sheds some light on the factors that shape today's policy debates and builds the groundwork for the Kenya-focused chapters and the specific case studies that follow. Global narratives at the macro- or landscape-level link different actors and dimensions (i.e., social, technical and institutional) to create national regime structures and narratives. Therefore, the next chapter takes a more detailed analysis of the national processes in Kenya to show the key political, institutional and social aspects that affect food security and fertiliser policies and programmes for smallholder farmers. It builds on the multi-level analysis to examine how meso-level factors affect the delivery of input-support programmes and creates links between decision-making systems at national and supra-national levels.

Chapter 4

Politics, Power and Bureaucracy: National food security policymaking in Kenya

This chapter builds on the Green Revolution overview presented in Chapter 3, providing a more detailed view of Kenya and showing how the wider macro-level narratives have been transposed to the Kenyan context. Here, I describe Kenya's current national policy landscape, highlighting the key political, institutional and social aspects affecting food security and fertiliser policies and programmes for smallholder farmers. This chapter also explains how certain political, institutional and social configurations and interests drive the narratives that promote specific agricultural technologies used in Kenya's 'Green Revolution' approaches for smallholder farmers. Emphasis is placed on the range of views that dominate Kenya's political landscape, from those that perceive food insecurity as primarily a lack of technological advancement, to those that combine technology and social spheres to define a wider view of food security and soil fertility. The common element tying these perspectives together is the ubiquitous role played by maize in influencing the country's national food security policies (Thompson et al., 2010).

The overarching purpose of this chapter therefore is to analyse the political, social and institutional processes of different development actors in Kenya, including government, donors and development partners, to gain understanding on how they construct the food security narratives (e.g., through discourse, practices, incentives, histories, etc.) that ultimately influence policymaking. Thus, the chapter traces the evolution of the agricultural policy environment in Kenya with specific reference to food security policies. It examines the role of key research and development institutions in influencing their design and implementation. The assessment is based on existing literature and detailed interviews with selected representatives of government ministries and other public and private entities, such as the Kenya Agricultural Research Institute (KARI), donor agencies, NGOs, domestic and international seed and fertiliser companies, policymakers and researchers (see Annex A). By unpacking the range of

agricultural policies championed by political actors within Kenya over time, the chapter repositions the food security debate with a focus on power relations, social standings and influences.

The first section offers a brief overview of the history of agriculture-based interventions and policies in Kenya. It looks at key aspects of Kenya's agrarian history to explain why the framing and promotion of agricultural polices has remained so stable, from pre-independence to present-day policies. It stresses how this agrarian system was constructed through policy decisions reinforced by narratives prevalent at that time and supported by particular actors over time. It shows the central place of agriculture in defining the history of the country and how past policies and institutions continue to shape and influence current processes today. This historical introduction shows how the Green Revolution unfolded in Kenya with a local flavour, due in part to certain unique Kenyan attributes.

The second section takes the historical context and frames it within Kenya's current problems of rising food insecurity and declining soil fertility. This section examines the current political narratives created by different actors and networks. It revolves around the different solutions, including technical (types of fertilisers and application rates) and institutional/administrative (subsidies, delivery, extension, markets, agro-dealers, etc.), being debated today. It highlights different national actors' visions of how to reach food-insecure farmers, based on their perceptions on the causes of Kenya's current food security situation. These different narratives are used to either justify or oppose the use of a subsidy programme to assist smallholder farmers.

By showing the evolution of these different narratives surrounding food security, this chapter seeks to demonstrate how politics, policy, economy and social contexts affect the creation and configuration of input-support programmes in Kenya. It gives further evidence to the assertion that a mix of socio-technical configurations ultimately affects the creation of different programmes. This conclusion in turn provides the foundation for the in-depth analysis of the two input-support case studies (NAAIAP and MVP) in the subsequent chapters.

A brief history of agrarian change in Kenya

A great deal has been written about Kenya's agrarian history and this section does not cover all this material. Instead, it briefly examines the political economy of the country's agricultural development during the 20th century. It highlights the key policy decisions made by colonial and post-independence governments that directly affected agricultural growth and land use patterns, and the effects these had on smallholder farmers. It touches lightly on certain policies surrounding land tenure, agriculture promotion, soil conservation and decentralisation. The purpose is to show the central role of agriculture in defining the history of Kenya, and how certain policies continue to shape and influence current policy processes.

Pre-independence: a fight for land and policies of alienation

Prior to the arrival of the British colonists, the main social and political structures in African communities consisted of subsistence agricultural and pastoral economies (Cone and Lipscomb, 1972; Leys, 1974). In most areas, the vast amount of land available allowed various forms of agriculture, including shifting cultivation (Smith, 1976). With the arrival of the colonists, the pace of agricultural commercialisation accelerated (Cone and Lipscomb, 1972; Berry, 1993). Access to land changed with the new economic and political structures imposed by the colonists (Berry, 1989).

Two land ordinances were passed by the colonial administration in 1902 and 1915 to attract new European settlers (Cone and Lipscomb, 1972). These allowed for the appropriation of large tracts of arable land (20 percent of arable land was set aside for exclusive European use) and led to the creation of the 'White Highlands' (Cone and Lipscomb, 1972; Smith, 1976). The colonists introduced new crops, the most important of which was maize. The British agricultural policy at the time was directed at maximising the export of cash crops grown by the European settlers (Mungeam, 1966; Sorrenson, 1968). This meant that very little attention was given to African agriculture (such as sorghum and millet), as Africans were forbidden to grow export crops (such as coffee, tea or pyrethrum) so they did not threaten the monopoly of the European settlers (Spencer, 1983; Berry, 1993; Ochieng' and Atieno-Odhiambo, 1995).

After the First World War, an influx of new British settlers created a greater demand for land (Cone and Lipscomb, 1972). The second 'Crown Lands Ordinance' (1915) declared all 'waste and unoccupied' land in Kenya to be Crown Land and subject to alienation (Aliber et al., 2004: 11). The colonial authorities then created 'Native Reserves' for the African population, commonly in areas less suitable for European settlement (Aliber et al., 2004). The government drew the boundaries of the reserves along what they deemed to be tribal lines and Africans were forbidden by law to live in any reserve other than those allocated to their ethnic group (Sorrenson, 1967; Aliber et al., 2004). This act had the effect of linking land rights firmly to social identity (Sorrenson, 1967; Berry, 1992). As stated by Aliber (2004: 11):

> *A clear process, which linked ethnicisation and politicisation of mechanisms for control of land, had begun in earnest.*

During the 1930s, several factors combined to influence the Kenya Land Commission's policies towards African farmers. These included the increasingly poor conditions on the reserves, political fears of the settlers, the Great Depression, the global anti-erosion movement, recurrent droughts, and the new professionalism of the colonial agricultural bureaucracy (McCracken, 1982; Anderson, 1984; Rocheleau et al., 1995). Concern over soil conservation became a priority for many European settlers, but behind it lay an anxiety about the Depression and fears about the legitimacy of their land ownership and the preservation of the White Highlands (Anderson, 1984). Environmental concerns became a weapon used by the settlers to legitimise their land claims and to persuade the colonial government to continue supporting their agricultural enterprises. The need to address this perceived soil erosion 'crisis' became the pivotal policy action that began to politicise the land crisis (Throup, 1987; Mackenzie, 1991).

Land scarcity in the reserves meant that African farmers had to reduce the frequency of the traditional fallow period and adopt continuous cropping techniques. When this intensification was combined with the replacement of traditional crops (e.g., sorghum and millet) with maize, it further depleted soil fertility and yields began to fall (Rocheleau et al., 1995). The colonial government began to introduce policies and programmes to combat soil erosion (terracing), recondition the soil (enclosing and

seeding of grazing land), and reduce livestock stocking rates. However, each of these measures addressed the symptoms of soil erosion rather than the causes and had limited success (Smith, 1976). In addition, the soil conservation campaign rested on external experts' advice on the construction of narrow bench terraces, which was both labour and land absorbing (Mackenzie, 1991). Terracing had limited impact on soil conservation and instigated growing conflict among the local communities forced to build them (Throup, 1987). Ultimately, opposition to the imposed conservation schemes united the African population against the colonial administration (Sorrenson, 1967: 91). Increasing fears of further land grabbing by the European settlers provided the necessary impetus for local political upheaval (Mackenzie, 1991).

The Second World War also had a profound effect on European and African farmers. During this period, the British began to focus on increasing wartime production of crops (Rocheleau et al., 1995). Yet, the European farming sector had suffered greatly from the Depression in the previous decade and did not have sufficient capital for investment purposes (Smith, 1976). Therefore, the colonial government introduced the 'Increased Production of Crops Ordinance' (1942). This included the concept of short-term credit and guaranteed minimum return for crops on European-owned farms that were on government contracts (Smith, 1976). This new wartime policy created a two-tier system with different prices being offered for maize from the European- and African-owned farms. The differential pricing scheme was not only unfair to the African farmers, but also brought large profits for the European settlers (Spencer, 1980). This discriminatory pricing policy was compounded by an increasing focus on maize grain exports and a period of bad weather, which led to severe food shortages and worsening livelihoods on the African reserves (Spencer, 1980). The resulting food crisis, along with continued pressure on land and increasing rural resistance to government controls, contributed to resentment over the colonial state and gave rise to the Mau Mau Rebellion in the 1950s (Throup, 1987).

In 1954, as growing unrest began to spread, the British implemented the 'Plan to Intensify the Development of African Agriculture in Kenya' (also known as the 'Swynnerton Plan', named after RJM Swynnerton, then Assistant Director of Agriculture). The Swynnerton Plan aimed to address the land crisis by reforming the land tenure system, consolidating fragmented holdings, issuing freehold title to

Africans, intensifying African agriculture, providing access to credit and removing restrictions on growing export crops (Leys, 1974; Bradshaw, 1990; Rocheleau et al., 1995). However, the Swynnerton Plan was not framed to attain 'equality' but to increase productivity. The result of land consolidation and loans meant that wealthier and politically better connected African farmers with larger tracts of land benefited disproportionately over poorer smallholders, who experienced increasing landlessness and unemployment. This inequality was not an accident, as it was outlined in the Swynnerton Plan (1955: 10, cited in Leys, 1974: 52):

> *Former government policy will be reversed and able, energetic or rich Africans will be able to acquire more land and bad or poor farmers less, creating a landed and a landless class. This is a normal step in the evolution of a country.*

Thus, the Plan had twin political and economic objectives (Ochieng, 2007). The economic purpose was to create a new class of 'progressive' African farmers (Berry, 1993) who could produce commercial crops with improved techniques and contribute to the economic development of the country. It was believed that this would create a politically stabilising influence and help to quash the growing Mau Mau resistance movement (Berry, 1993; Ochieng, 2007). The Swynnerton Plan was credited with tripling agricultural output between 1955 and 1964 (Shipton, 1988; Bradshaw, 1990). Yet, the extent to which the growth of the agriculture sector can be attributable to the policies implemented and the overall impact of the Swynnerton Plan is still hotly contested (House and Killick, 1981; Aliber et al., 2004). In the end, the Plan failed to quash the growing resentment over colonial rule and restricted access to land. According to Bates (1989), the Mau Mau Rebellion that followed may have failed militarily, but it was successful in convincing the British that a white minority could no longer hold power in Kenya.

Post-independence: controlling the means of production and redistribution

Kenya ultimately gained its independence in 1963 and the new post-independence government immediately focused on agriculture as the main driver of economic growth. However, some critics claim that independence did not have a large effect on the major ideology of the state (Smith, 1976; Ochieng' and Atieno-Odhiambo, 1995). According to Ochieng' and Atieno-Odhiambo (1995), there was no structural break with the

colonial state and the new government simply expanded the former colonial administrative and economic infrastructure. The Swynnerton Plan continued mostly intact after independence (Swallow and Kamara, 2000). However, the new government did embark on a major land reform policy. Redistribution of land, together with commercialisation of smallholder agriculture, was viewed as the solution to the country's poverty and hunger (Rocheleau et al., 1995).

The government created programmes to distribute parts of the former white settlers' farms in medium- and high-potential areas to smallholders (Nyangito and Okello, 1998). One such programme was the 'Million Acre Scheme', in which 35,000 families were settled on 470,000 hectares of land. This was followed by the 'Haraka Scheme', in which 14,000 families were settled on 105,000 hectares (Senga, 1976). The cost of financing the Million Acre Scheme increased over the next 10 years. The amount borrowed from the World Bank and other donors to pay for the land reform accounted for a third of Kenya's entire foreign debt (Leys, 1974: 74).

Yet, Kenya's land reform policies were far from egalitarian. The land tenure reform may have allowed some farmers access to land, but this happened at the expense of others (Rocheleau et al., 1995). The new regulations once again strengthened the property of a few wealthier and better politically connected Kenyans, but left many men – and most women – with less secure access to resources and reinforced regional biases that continue today. Most importantly, women's rights to land were severely undermined, and most women retained no legal authority over the land they occupied or farmed (Rocheleau et al., 1995).

Apart from partial redistribution of land, the first years of independence brought little change in the overall strategy of the State. By the 1970s, with growing evidence of unequal development, the government began to create policies designed to generate a more egalitarian pattern of rural income and growth. One such policy involved equalising smallholders' access to productive resources, such as farm inputs, credit, infrastructure and amenities, through national agricultural subsidies and government credit programmes (Heyer and Waweru, 1976; Killick and House, 1983; Bates, 1989).

The new government also put in place new policies to foster the growth of the agricultural sector. This involved government intervention in nearly all aspects of agricultural production and marketing (Nyangito and Okello, 1998). The use of agricultural inputs, such as fertilisers, was promoted through the licensing of distribution and state subsidy programmes, and the provision of inputs and credit was encouraged through farmers' cooperatives and crop marketing boards and authorities (Heyer and Waweru, 1976). The government had little confidence in the private sector industry to deliver fertilisers and created a near monopoly on fertiliser pricing and distribution (Freeman and Kaguongo, 2003).

Yet, it was in marketing that the government interventions in agriculture were most pronounced. Agriculture marketing was controlled through state-run institutions, which had a monopoly in the marketing of the commodities (Nyangito and Okello, 1998). A board or an authority was created for each product that was considered as essential for the country. These institutions had complete control over the commodities' production and marketing (Nyangito and Okello, 1998). Kenya's policy towards maize marketing followed the structure put in place by the colonial government, which had created a tightly controlled maize sector to provide economic support to European settlers in the Central Highlands. This control was maintained after independence and continued for the next three decades (Wangia et al., 2002).

An era of mixed liberalisation and retraction: Setting the scene for today

During the 1980s, the country's economy, including the agricultural sector, entered a period of general decline (Ochieng, 2007). Both the balance of payments deficit and the government's budget deficit increased, due to falling world coffee prices and increasing world oil prices (Mosley, 1986). From 1981 onwards, the government began a major shift away from strict control over the agriculture sector and towards more liberalised markets with the introduction of the Structural Adjustment Programmes (SAPs). (Nyangito and Okello, 1998). These programmes, promoted by the World Bank and the International Monetary Fund, advocated reduced government control on the agriculture sector and a more open environment for private sector participation.

While the World Bank continued to put pressure on the government to eliminate the distortions in the market, the official commitment to these reforms was often lacking and the reforms met with overt resistance (Nyangito and Okello, 1998). Therefore, the liberalisation period was fraught with patchy, intermittent and unstable development, due in part to the government's unwillingness to comply. The government was especially slow to make changes in such key sectors as its maize marketing policies (Gerdin, 2002).

By 1980, the years of monopolisation by the state maize marketing board had adversely affected Kenya's main food crop. For 45 years the state marketing board regulated prices and exercised the right to veto all private bulk sales of maize between districts (Mosley, 1986). A large price gap had grown between the price paid to the producer and that paid by the consumer. There was increasing consensus within the donor community that:

> *It was heavy state involvement that impeded the development of efficient input and output markets and thus was responsible for the stagnation, and even the decline in agricultural productivity (De Groote et al., 2005: 34).*

In this light, the World Bank made liberalisation of the agriculture sector a key condition of its Structural Adjustment loans. International donors began to impose conditions to force the government to comply (Mosley, 1986). Eventually, the Government of Kenya agreed to a process of maize liberalisation (Wangia et al., 2002). However, during the 1990s, even with liberalisation, the economy did not improve and production of most agricultural commodities continued to decline (Nyangito et al., 2003). Kenya's average annual rate of agricultural growth slowed to 1.1 percent in 1990-2000 (Ochieng, 2007: 456).

The overall impacts of the policy reform and SAPs on the long-term development of the agriculture sector have been mixed (Nyoro and Jayne, 2000). According to Nyangito (2003), liberalisation did not have the intended results due to several factors, which include poor sequencing and timing of policies that were not in line with the institutional capacity to implement the changes. In addition, instability and lack of coordination in policy implementation affected investors' confidence in the markets

and did not allow the private sector to take up the activities once controlled by the government (Nyoro et al., 1999). Dorward et al., (2004b: 78-79) state:

> *One reason for states' often half-hearted commitment to liberalisation, particularly in food crop markets, is their recognition that pervasive market failures prevent the private sector from delivering the necessary services. Policymakers therefore continue to attempt to intervene to remedy these failures.*

These uneven policies of liberalisation, together with unstable policy implementation, created an uncertain environment. There were no adjustments to ensure continuation of important rural services targeting food-insecure farmers. The agricultural credit system collapsed, the agricultural extension service was reduced substantially, and funding for agricultural research fell (De Groote et al., 2005). The lack of such important agricultural services continues to affect Kenya's food-insecure smallholders today.[11] Therefore, Nyangito and Okello (1998) argue that the government's implementation of its liberalisation policies adversely affected the development of the agriculture sector and have laid the groundwork for Kenya's present agricultural and food security environment.

Kenya's current policy landscape and food security narratives

This section outlines Kenya's current food security and soil fertility narratives and reinforces the ways in which current agricultural policies remain connected to established historical narratives. By highlighting the different framings and perspectives on food security held by government, donors and researchers in Kenya, the section demonstrates that policy "is the product of the interested actions of private parties who bring their resources to bear upon politically ambitious politicians and the political process" (Bates, 1989: 5). By so doing, it shows how these narratives have a strong influence on the policy solutions promoted by the government and donors, and how they affect the conceptualisation, design and implementation of food security programmes.

[11] The effects of liberalisation on markets and stability of food prices are still being debated. See Poulton et al. (2006) for an overview of the debate on state intervention for food price stabilisation in Africa.

Kenya's political sphere – contrasting narratives on the causes of food insecurity

Arriving at a common definition of food security in Kenya is difficult, with different development actors holding various viewpoints. Reflecting broader global discourse (see Chapter 4), Kenya hosts an ongoing debate between those who view food insecurity strictly in terms of productivity, e.g., the need to improve production through increasing agricultural inputs, and those who expand the definition to include a more systems-level approach, e.g., addressing political, institutional and social factors that affect availability, access and distribution. As Richard Jones, a senior scientist at the Nairobi campus of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) states:

> *The definition of food security has changed so much since the 1970s that it is an amorphous term these days. The term needs to be used with caution; otherwise people will be talking about different things.*[12]

For the Government of Kenya, addressing food security is linked to reaching national food self-sufficiency. This is a key goal for the long-term development of the country. 'Vision 2030' is the government's current policy statement for the future, and it relies on agriculture as a key sector to address food security and economic growth (GOK, 2007). Kenya's Agricultural Sector Development Strategy (ASDS) outlines the strategy for agriculture, which has its origins in the previous Strategy for Revitalizing Agriculture (SRA).

The SRA focused heavily on increasing agricultural productivity and was originally hailed as a paradigm shift for Kenya's agricultural ministries (Pearson et al., 2004). However, the SRA has been criticised for the lack of stakeholder consultation in its formulation. Smith et al. (2004: 27) argue:

> *This lack of consultation also means the significance of the paradigm shift and culture change... has not been fully appreciated by technocrats from within the Ministries or by those who have enjoyed, or are enjoying, patronage and rents from the agricultural sector through the current level of government involvement and regulation of production and marketing activities*.

[12] Interview, Richard Jones, Assistant Director, ICRISAT, Nairobi, March 11, 2010

The current strategy, ASDS, has two main overarching policy themes: increasing productivity and developing/managing the key factors of production (GOK, 2010c). Vision 2030 guides the agriculture policy, which has highlighted agriculture as the economic growth engine for Kenya and one of the key sectors to deliver on the 10 percent annual growth target. Maize production will continue to play a large part in that growth and it remains an important food security crop for the majority of smallholder farmers in Kenya. Therefore, the production of maize has become elevated to a highly political level. Kenya's current national food security programme is biased predominately towards improving maize production, almost at the expense of a diversified food basket. As indicated in the previous section, this bias was favoured by the colonial government and since then the sector has been "characterized by heavy government interventions dating back to the colonial period" (De Groote et al., 2005: 33). The connection between maize and politics can still be seen in the current policies and political preoccupation. According to Hannington Odame, Executive Director of the Centre for African Bio-Entrepreneurship (CABE):

> *The national narrative of a Green Revolution in Kenya is hinged on maize. It has three crucial features for farmers – food, cash and security. Therefore, maize has become a very politicised crop. This has led to a political structure where there are few policies directed towards the smallholder to offer alternatives and to diversify out of maize production.*[13]

The importance of maize as a measure of national food security has led to a unique policy structure within the country. Critics argue that the government's maize production strategy is influenced heavily by political favouritism and that the benefits have not been equally promoted throughout the country. For example, a World Bank study found Kenya's current maize production structure was skewed in favour of two percent of maize farmers (World Bank, 2009: 14). These maize growers account for 50 percent of the "marketed maize production in Kenya, and their average maize sales income is over twenty times that of the bottom 70 percent of households" (World Bank, 2009: 14).

The majority of investments have focused on Kenya's high potential areas, while investment and development in the rest of the county has been marginalised. As a

[13] Interview, Hannington Odame, Executive Director, CABE, Nairobi, April 22, 2010.

result, maize production has been concentrated in small pockets, particularly in the higher potential areas of the Rift Valley and Western Province. This focus on Kenya's limited high potential areas also has some foundation on historical policies that aimed to protect the interests of the white settlers and to develop these areas for export production. According to Phil Dobie, Director of the United Nations Development Programme (UNDP) Drylands Development Centre:

> *There is a strong hangover from the colonial focus on just the high potential area and not the arid or semi-arid parts of the country. Therefore, this has meant that the focus in the past has been on only 20 percent of Kenya's land mass and rather ignored the rest of it. And that political bias still exists today.*[14]

Likewise, the Government of Kenya still has a hand in the coordination of maize markets. After the liberalisation period of the mid-1980s, the dominant role of the National Cereals and Produce Board (NCPB) in purchasing, marketing and setting the price for maize was severely curtailed. However, NCPB continues to play a role, albeit much reduced, in the maize markets and "the government still influences maize prices and imports" in the name of national food security (Alene et al., 2008: 319). The rationale advanced by the government relates to the management of the national food reserves (especially during periods of drought), ensuring access to affordable and good quality seed, guaranteeing prices for producers and protecting consumers from high maize prices (Ikiara et al., 1995: 62).

Maize is not the only sector that garners such heavy public sector attention. As mentioned earlier, the Government of Kenya has a long history of intervening in the fertiliser sector. While liberalisation of the fertiliser industry (in terms of importation and distribution) has taken effect, the government still interferes in fertiliser distribution under the banner of ensuring national food security. Part of the government's rationale for continued interventions is that it still holds a level of distrust of the private sector's ability to provide smallholder farmers with adequate and affordable inputs. Therefore, the government points the finger at market failures and the high cost of inputs in Kenya as a reason to control the distribution of these commodities. These concerns continue to shape national policies related to fertiliser supply and marketing.

[14] Interview, Phil Dobie, Director, UNDP Drylands Centre (retired), Nairobi, February 11, 2010.

One example of the change in policy direction came about during the 2008 food and energy crisis. When the crisis hit, food and fertiliser prices in Kenya soared and the government was quick to highlight the failure of the markets to deliver inputs to farmers. It thus began to import US$183 million in fertiliser inputs, providing these to farmers at a subsidised rate (Ariga et al., 2009: 2). Farmers in Western Kenya called this 'Ruto's fertiliser', after the incumbent Minister of Agriculture, William Ruto, and it was distributed by the NCPB at a reduced rate to qualifying farmers.

The focus on agricultural technologies, such as fertiliser, as the solution to food security is one narrative that continues to permeate Kenya's policy environment. According to ASDS, the country's current agricultural development strategy:

> *Experience has shown that where agriculture is led by technology, poverty alleviation and food security can be achieved... Currently, the use of improved inputs such as hybrid seed, fertilizer and pesticides or machinery is low. Increased productivity is possible in smallholder farming, but it will require concerted efforts to encourage farmers to adopt modern farming practices* (GOK, 2010c: 29).

What this passage illustrates is the government's constant emphasis on the need for smallholder farmers to adopt 'modern farming practices', tied explicitly to technologies, and this perception continues to dominate national food security narratives and permeate policy-setting processes. It offers an insight into how the national government frames the food security problem within a modernisation agenda. As Long and van der Ploeg (1994: 2) state:

> *...the practice of modernization was (and still is) shaped by sets of external interventions, mostly centralized in state-agencies aiming to introduce new organisational models of farming, new interlinkages between farming, markets and market-agencies, new technological innovations meant to replace exiting techniques and knowledge, new forms of socialization and techno-economic training and, last but not least, new models for the definitions of roles and identities for farmers.*

While technology is an important component to improving agricultural productivity for smallholder farmers, the analysis of the two input-support programmes in the following chapters illustrate that technology by itself cannot provide the silver bullet that achieves food security. Instead, the analysis demonstrates the need to go beyond this narrow

'technology for productivity' narrative and to broaden the scope to include the multitude of social, economic and institutional factors that shape food insecurity.

Expanding the productivity debate

The Government of Kenya's focus on productivity has led some critics to question whether it addresses the needs of the food insecure. Food sufficiency or availability is only one aspect of food security and is not the sole answer to the food insecurity problem. It does not address issues of access to food, stability of food supply and utilisation of safe and nutritious food by those vulnerable to shocks and stresses in food supply chains. In this view, Richard Jones, Assistant Director of ICRISAT, argues that:

> *Pursuing national food self-sufficiency as a means of addressing food insecurity is a bit of a red herring and may not improve the wellbeing of the very people it aims to address.*[15]

Leigh Stubblefield, a livelihood advisor from the United Kingdom Department for International Development (DFID) echoes this view:

> *Kenya has a structural food security problem because there is a mismatch between the supply and demand sides of the equation. Kenya is not looking at food security in a very pro-poor way. The food security policy is skewed around production. It focuses less on trade and much less on affordability. There is less consideration of nutrition and the importance of those issues in human development.*[16]

These perspectives have led to an expanded food security view among some development actors in Kenya that incorporates a functioning food system, rather than strictly food self-sufficiency. One expanded definition of food security focuses on the importance of markets. It recognises that even very food-insecure households participate in markets and argues that these farmers can be more dependent on markets than the better off, who are able meet their food requirements. There are thus links between food security and income enhancement through improved markets. This storyline states that poorer farmers have less ability to purchase production-enhancing inputs and thus have less to sell at markets, and need to purchase food to supplement

[15] Interview, Richard Jones, Assistant Director, ICRISAT, Nairobi, March 11, 2010
[16] Interview, Leigh Stubblefield, Livelihood Advisor, DFID, Nairobi, March 10, 2010

their limited production. The solution, according to Akin Adesina, former-Vice President of the Alliance for a Green Revolution for Africa (AGRA), is that food security needs to be implemented at two levels:

> *First, the household needs to have access to affordable inputs to produce enough so that they have a marketable surplus that they can sell. Second, the role of the state becomes one of supporting both sides of the equation – input and output markets – to fix the fragmentation of the value chain and make markets work better for food-insecure smallholder farmers.*[17]

This expanded market-based narrative argues that the government's underlying goal of maize self-sufficiency is misguided, based on the viewpoint that most of Kenya's households are net sellers of maize (Brooks et al., 2009). This misconception has led policymakers to support a high maize price policy by restricting maize imports into the country and by purchasing maize through NCPB at prices higher than market value. The result is that Kenya has one of the highest maize prices in eastern and southern Africa. Supporters of this market-based narrative point to a study by the Tegemeo Institute of Egerton University (Jayne et al., 2005: 6) which shows:

> *... the proportion of rural households that are net buyers of maize is much higher than previously thought.*

They argue that the government's high maize price policy actually harms a large number of the farmers it is intended to help, since up to 82 percent of the smallholders surveyed (in Western Kenya) are net buyers of maize (Jayne et al., 2005: 6). Therefore, high prices have a wider negative effect than expected on food-insecure smallholders, who must purchase food during some parts of the year.

Even with these maize-focused policies, Kenya does not produce enough maize to meet domestic consumption. The country fills its deficit by importing maize from neighbouring Tanzania and Uganda. Therefore, Kenya remains very sensitive to changes in global commodity prices. The 2008 food and energy price crisis had a large impact on the food security situation in Kenya. This crisis not only limited the ability of poor households to purchase food, it also restricted the poorer smallholder's access to affordable inputs, such as fertilisers. According to Poulton et al. (2006), food price

[17] Interview, Akin Adesina, Vice President, AGRA, Nairobi, February 15, 2010

volatility has a different effect on households that are food secure (surplus) versus those that do not produce enough food (deficit). While high prices will encourage surplus households to diversify to other non-staple, higher-value crops, the opposite will happen with deficit households. These poorer households react to volatile prices by continuing to invest scarce resources in staple food production, resulting in a "major impediment to many poor households climbing out of poverty" (Poulton et al., 2006: 343).

Climate change and a number of environmental challenges have further compounded the food price crisis. Prolonged droughts in recent years (2008–2011) [18] have increased incidence of malnutrition and refocused the debate on national food security. In addition, there have been rising security threats from Somalia and continued conflict on the northeast border. These wider global political and economic contexts make food assistance and food security an important feature of foreign and domestic policy to address economic, social and political instability.

To address these domestic and wider trends, the food security narrative in Kenya will need to become broader than the productivity and technology narrative or market-focused narratives described above, and reframed within a wider systems context that includes social, ecological, institutional and political factors. However, which narrative takes hold and shapes the food security policies has as much to do with Kenyan politics as it does with evidence and research knowledge surrounding food security. In the same fashion that the colonial government focused on maize production for European settlers as the politics of the day, so too is the present government's focus on maize production relevant to the current socio-political environment, but within a very different political balancing act. The current environment has thus evolved over time and is reflected in today's unique coalition politics. The next section goes into further detail on the interface between politics and bureaucracy.

[18] See data on Kenya from the Famine Early Warning Systems Network (FEWS NET) on agro-climatic monitoring and emerging food security issues at http://www.fews.net/Pages/country.aspx?gb=ke&l=en

Politics and bureaucracy: the creation of institutions and administrative structures

Another major challenge to addressing food security is the ability of the administrative structure to implement food and agriculture policies. As mentioned earlier, power and politics play an interesting role in food security policy in Kenya. There is extensive literature on the role of political elites, networks and alliances in the national political environment and policy agenda setting (cf. Throup, 1987; Bates, 1989; Throup and Hornsby, 1998; Anderson, 2002). For example, Throup (1993: 382) argues:

> *Astute use of government patronage, civil service and parastatal appointments, low-interest loans, government contracts, and rural and urban land grants, had ensured the continuing loyalty of the vast majority of the educated elite and political class.*

Many of these alliances and the policies and social networks with which they are associated have their historical roots in the colonial era but continued into the post-independence period (Bates, 1981). This is especially relevant in the agriculture sector. According to Colin Poulton, a food policy expert with the School of Oriental and African Studies (SOAS) at the University of London:

> *Agriculture Ministers are often not judged by their capacity to run a ministry, and not on their public policy objectives. Rather it is implicit that you have the resources of your ministry to provide rents down your patronage networks to deliver the national votes of your region.*[19]

From this perspective, technical and political issues become intertwined in the policy process and are influenced heavily by ethnic and regional politics. Thus, agriculture and food security policies become part of a political environment of rent seeking and coalition building for those in power, and so become linked to a small, but powerful network of larger commercial farmers around the country. A poor farmer has little control over the policies that are implemented and few avenues within which to seek redress. Therefore, smallholder farmers look at elected officials and village elites to provide local public goods, such as subsidised inputs, that benefit their village and gain votes for the politician. In this way, small-scale farmers become what Srinivas (1955)

[19] Interview, Colin Poulton, Research Fellow, School of Oriental and African Studies, University of London, Nairobi, February 10, 2010.

terms ‘vote banks’, in which politicians provide citizens with benefits and favours to garner support for their political interests. Colin Poulton explains:

> *What you get are policies that effectively disperse patronage to particular regions. If there is a coincidence between what can be claimed as national policy and of interest of relevant ministers or powerful politicians, then these things happen. Therefore, a minister of agriculture may decide to promote a subsidy policy and to purchase maize to support and appease the larger farmers.*[20]

Therefore, complex and longer-term policies, particularly those that require more systemic change, offer fewer incentives to the political elites to implement. However, certain changes occurring over the past few years have merged political interests with a food security focus. Andrew Karanja, a World Bank economist in Nairobi, states:

> *Food issues are on top of the political agenda. During the last national elections [2007], one of the main driving forces was the food crisis and there were even food riots. Therefore, the government had to do something to cool the temperatures down and appease the population. They cannot ignore it any longer.*[21]

The political benefits of focusing on food, with the potential for winning votes, provide a strong impetus behind the agenda-setting process for a number of national-level politicians and development actors. This agenda-setting process was evident after the 2007 post-election violence, with politicians manoeuvring to position themselves in a favourable alliance. Political rhetoric focused on issues of national food security with promises from one political group to do more than the other to address food insecurity. Consequently, post-election politics has been marked by “uncertain policy regimes” (Aringa and Jayne, 2011: 271) which has led to large increases in government interference in fertiliser marketing mechanisms though procurements and distribution of subsidised fertiliser. Current policies, therefore, must be seen in relation to the balancing act of coalition politics in a highly tense and unstable political setting.

[20] Interview, Colin Poulton, Research Fellow, School of Oriental and African Studies, University of London, Nairobi, February 10, 2010.
[21] Interview, Andrew Karanja, Agricultural Economist, World Bank, Nairobi, March 16, 2010.

This uncertain policy regime has led to an uncertain environment for both the private sector and farmers. According to Andrew Karanja, these policy reversals have hampered concrete change:

> *After liberalisation of the fertiliser sector, the private sector has been driving the agenda in distribution, but of late the government has been using the excuse of market failure to come and interfere with the same markets and this has created a situation where nobody knows what is going on.*[22]

These policy reversals and inconsistencies in government policy messages have longer-term effects on the economy. Uncertainty can add elements of risk to industry, which can increase the costs of operating and provide "powerful disincentives to invest and produce" (Nyoro, 2002: 39). Some experts blame the poor performance of the agriculture sector on failures of institutions and governance as well as agro-ecological factors. According to Ng'ethe et al. (2004: 14), the state maintains numerous public sector agencies that are inefficient, take up a large percentage of public spending on agriculture and have unclear mandates, yet "provide an important source of political patronage". Through this lens, failure is the result of an inadequate public sector which "encourages clientelism and corruption" (Booth, 2011: 3).

What this research shows is that policy emerges from the realities of the political setting and cannot be seen solely as a condition of governance failures or a lack of political will. For example, due to the politicisation of maize, networks of power and politics have a strong hand in the creation of food security polices within Kenya. Therefore, a full understanding of food security policies requires an exploration of the institutional constraints and the enabling factors at the macro- and meso-levels, which are connected to the conditions at the micro-/farm level (Booth, 2010: 7).

According to Festus Murithi from the Kenya Agricultural Research Institute (KARI), Kenya's national and local institutional and organisational structures have at times perpetuated the problems of food insecurity and decreasing soil fertility. He blames many of the problems on the lack of capacity of the administrative structures in Kenya to carry out the policies. Murithi sums up this view by stating:

[22] Interview, Andrew Karanja, Agricultural Economist, World Bank, Nairobi, March 16, 2010.

> *The government's policy documents are well meaning and if we implement all these policy documents, then we would come a long way. However, what is lacking is an implementation strategy to accompany these policy document statements.*[23]

This technocratic argument that the technological solutions are available and it is just proper implementation that is needed was a recurring theme in my interviews. For example, three senior Kenyan policy analysts agreed that Kenya has strong technical experts who are capable of analysing the situation and producing the reports needed. However, what is lacking is the capacity to translate these technical documents into appropriate policies and the administrative structures needed to implement them.

Antti Seelaf, a senior advisor for the German Agency for International Cooperation (GIZ), seconded to Kenya's Agriculture Sector Coordination Unit (ASCU), states:

> *I do not think we require technical assistance to have good research in improving fertility, good farm management and so on. We want the assistance that will tell me how I can better coordinate the ministries, administration, management issues that deal with corruption.*[24]

He goes on to state that without this clear linkage between policy and implementation, there is a lot of room for political manoeuvring and positioning for personal gain. What this viewpoint represents is a slight shift from the prescriptive, top-down technocratic solutions, towards the view that 'governance' and well functioning bureaucracies are the solution to the food security problem. Governance remains an important component in the creation and implementation of policies, yet, similar to the technocratic or market fix narratives mentioned previously, this viewpoint overlooks the effects of politics on the creation of both the narratives and policies on food security.

This section therefore demonstrates that the creation of rural development policy, such as food security and agriculture, is not linear. Policy can come from an array of different directions and "implementation can be as much about agenda-setting and decision-making as execution of decisions" (Keeley and Scoones, 1999: 4). Policies are thus 'political technologies', in which the relationship between knowledge, power and

[23] Interview, Festus Murithi, Director, KARI, March 16, 2010.
[24] Interview, Antti Seelaf, GIZ Advisor/ASCU, Nairobi, March 24, 2010.

policy is combined with the power relationships that exist between citizens, experts and political authorities (Burchell et al., 1991; Foucault, 1991; Shore and Wright, 1997). The emerging Kenyan narratives pick up on the predetermined set of rules at the national and global levels to prescribe a productivity-based approach that entrenches the use of technologies as the central means for addressing food insecurity. These narratives are altered to fit within the unique Kenyan settings that are linked to particular actor-networks, institutions and political processes. However, politics is not the only process that influences food security policies and programmes. The next section examines important social interactions that continue to shape and influence the current national socio-technical system in Kenya.

Social interaction and citizen engagement in the policy process

While it is important to understand the role of elite politics and bureaucratic manoeuvres, it is also necessary to look at citizen engagement through civil society organisations (CSO) and NGOs. These social interactions influence the policy process in significant ways. CSOs, NGOs and private sector actors are increasingly influential in policy processes in Kenya. They have become very vocal in addressing their frustrations with the level of corruption in the country and made increasing calls for collaboration and inclusion in decision-making processes.

These non-state actors have multiplied in numbers over the past few decades, yet their impact within the food security policy-setting environment has been mixed. According to Antti Seelaf, while democratic change in Kenya has brought about greater accountability and transparency, civil society and the private sector remain highly fragmented. There are many individual players, with different interests and mandates, which have not come together under a unified voice to demand change. He explains that what is lacking is a credible representation of a compelling and coherent alternative perspective demanding better policy making from those in powerful positions:

> *If these private sector groups and civil society organisations could have the capacity to collect their views, prioritise them and make concrete suggests to*

> *feed that in through the ASCU thematic working groups, then they might have a voice. However, I have not seen that happen yet.*[25]

A representative from the Seed Trade Association of Kenya (STAK) also highlighted this problem:

> *In many democracies, the whole issue of lobbying and advocacy for change is very important and many international seed companies know how to position their issue and lobby for them. However, the problem is that the industry in Kenya does not know the art of lobbying and advocacy. These sectors need to be organised to be effective in lobbying and advocating for change. The private sector as a whole does not have a strong voice in policymaking in Kenya. They have to work harder to get policy shaped to serve their agenda. The private sector needs to be better organised and to have a bigger coalition. We need to have a regular forum where we meet with government and say that food security in our country is our problem. Then we can agree on common objectives, pick a few priorities, and determine how we are going to work together towards them. It is happening in other places with much worse agricultural climates than Kenya because there is a structure and an ability to shape the policy environment so that it works for all, especially for the farmer.*[26]

While a coordinated advocacy network within civil society and industry may be lacking, Kenya has an historic unifying social element in ethnicity. In their analysis of the 1997 national elections, Throup and Hornsby (1998) point out that ethnic origins and personalities of political leaders had far more importance in Kenyan politics than ideology or class. This was also the case in a recent study by Leonard et al. (2009), which once again showed how Kenyan politics is determined largely by ethnicity, kinship and neighbourhood. The main political parties are organised mostly along ethnic lines, with large numbers of people, especially in the rural areas, voting in accordance with their ethnic identities. To some extent, many CSOs and industry lobbies also reflect and reinforce these ethnic divisions.

Therefore, setting coherent policies directed towards food security, within such an ethnically, economically and geographically diverse country, becomes much more difficult. The result is a diverse set of narratives, linked to an evolving global landscape where Green Revolution narratives and national political framings all cohere around a focus on productivity-technology-fix as the primary solution for smallholder farmers.

[25] Interview, Antti Seelaf, GIZ Advisor/ASCU, Nairobi, March 24, 2010.
[26] Interview, seed industry representative, Nairobi, March 17, 2010.

The resulting regimes work to reinforce the institutions, practices and networks that frame the food security policies and subsequent programmatic decisions in Kenya.

Conclusion

This chapter shows how different aspects of history, politics, economy and social contexts have framed Kenya's agricultural development and food security policies. It demonstrates how policymakers build food security storylines with a limited focus on improving maize productivity. Kenya has seen an historical continuity of certain elements of the technical-productivity fix narrative. Yet, this narrative has not remained static and has been critiqued and adapted over time. The emerging food security narratives include a market-oriented fix (emerging from of the liberalisation era) and, more recently, a governance fix (emerging from debate on corruption, administration and political reform).

Even with these new emerging narratives, the proposed solution concentrates on streamlining policies to deliver a particular vision of food security with a maize focus, and hinges on the adoption of new technologies to improve productivity. The limits of such policy narratives to address the complex nature of food insecurity are apparent: complex politics, ethnic divisions, alliances and patronage direct policies to benefit some groups over others. This shows how the real internal dynamics and politics of Kenya drive the creation of policies, especially those linked to maize and food security. The politics of maize frame the discussions on national aggregate food security and the resulting programmes aimed at smallholder farmers. This political framing becomes apparent in the interaction between the high-level debates among policy elites – within governments and the donor community – and the complex negotiations that surround policy implementation and the reality on the ground. It is here, at the interface of these multiple levels, that the real effects of the politics, markets and social arrangements become more apparent.

However, these evolving narratives and policy formulations do not adequately capture the range and dynamic nature of farmers' practices in the field. Therefore, building on the multi-level framework described in Chapter 2, this analysis now moves from broad

general framing (at the global and national levels) to local specifics, where multiple negotiations and the micro-politics of what is and is not incorporated becomes more significant. This is when the macro-level narratives begin to unravel, or become recast, and new narratives that are more located, specific and socially determined, become apparent.

The next chapter, then, takes a closer look at the local level of the farming model in Western Kenya and demonstrates how the adoptability and sustained use of new technologies, such as hybrid seed and fertilisers, are linked intrinsically to the actors, organisations and social structures that constitute local livelihood strategies. It investigates the overarching argument that when programmes fail to take account of these critical social, political and institutional factors when introducing a new technology, they will encounter difficulties in uptake and will be unlikely to stimulate lasting improvements in productivity.

Chapter 5

Complexities in Smallholder Farming in Siaya and Butere: Negotiating and incorporating new technologies

The previous chapter outlined Kenya's national-level policy scene by highlighting key political, institutional and social aspects that affect food security and fertiliser policies and programmes. This chapter moves from a broad political and economic analysis to a narrower focus on the dynamics at the micro level. It looks at the specific and unique smallholder farming systems in Siaya and Butere Districts of Western Kenya. The purpose of this chapter is to highlight the ways in which the adoption and long-term use of agricultural technology depends on the actions of the key actors and specific practices and processes found within that locality. It argues that, once a technology is introduced, its interaction with local actors, networks, conventions and conditions (people, social relations, institutions, ecologies, etc.) is affected by an array of external factors. It is at the micro level that "variations to, and deviations from, the status quo can occur, such as new techniques, alternative technologies and social practices" (Moors et al., 2004: 39) resulting in niche creation and shifts in socio-technical structures.

This chapter focuses on the range of factors affecting local farming practices, which include social (e.g., networks, power relations and gender), economic (e.g., wealth groupings), field type and usage (e.g., home field, outfield and home garden) and agro-ecological setting (e.g., soil type, topography and rainfall patterns). In this chapter, I show how the use of such new technologies as improved seeds and inorganic fertilisers (as components of an input-support package), must be understood within this wider context. As highlighted in Chapter 2, technologies can fulfil their true functions *only* in association with human agency, social structures and organisations (Geels, 2002). Therefore, these technologies cannot be viewed as disembodied artefacts to be injected independently into a locality. Instead, their interactions become embedded within the wider socio-technical system that has a certain history, cultural context and institutional dimension, and is informed by highly differentiated farming practices and livelihood

strategies. In so doing, this chapter offers insight into the physical, social and political environments within which the two case studies were implemented.

The chapter begins with an overview of the farming systems found in Siaya and Butere, including the prevailing constraints and underlying narratives on soil health and food security. The second part explores some existing practices for managing soil fertility, including the use of fertiliser and hybrid seeds. The third part highlights how people respond to external interventions and how a system can evolve with the arrival and adoption of such new technologies as hybrid seed and inorganic fertiliser packages. Together, these three sections provide a detailed description of the socio-technical environment of Siaya and Butere, highlighting the diversity of local farming systems.

Farming systems in Siaya and Butere: Context and constraints

Butere and Siaya have two separate planting seasons. The first coincides with the 'long rains', (February–June) and the second with the 'short rains' (August–November). In this region, the long rains are considered much more stable and predictable (GOK, 2002). Timing is a very important element in the system, for planting and application of inputs. Farmers begin to prepare their land for the long rains in February. The actual planting time depends on the individual farmer's perception of the start of the rainy season. If farmers buy seed or fertilisers, they purchase these inputs close to the planting time in January or February. Late planting or late supply of inputs can hamper yield potential and has a direct effect on the food security of the household. Harvesting for the long rains ranges from mid-June to early August, depending on the location and that year's rainfall pattern.

Maize is the main staple cereal crop in both districts (GOK, 2001b, 2002; Masotsi et al., 2008). The farmers in my research area plant maize twice a year, during the long rains and the short rains, and it remains a critical component in their local food security strategies. However, the long and short rains vary greatly in terms of their frequency, duration and consistency, increasing the level of risk for maize yields. While maize remains the dominant long-rains crop, farmers adjust the land committed to maize during the short rains to compensate for their unpredictable nature and the shorter

planting season. The majority of farmers diversify their production strategies to mitigate against the risk of crop failure by planting their fields with other crops that do much better in the short rains, such as groundnuts, beans and sweet potato. Grace, an elderly farmer from Butere, explains the links between adequate maize yields and her decision on what crops to plant for the next season:

> *I must plant maize and beans twice a year because my production is not sufficient. If I get a good harvest in the long rains then I would not plant as much maize in the short rains, I would divide my land and plant more groundnuts. However, I cannot know that decision until the end of harvest time when I know my yields.*[27]

Low productivity and food insecurity are a constant concern in this area. According to a survey by Oiye et al. (2009: 1314), households in Siaya and Butere do not grow enough food to be self-sufficient and spend two-thirds of their household income on additional food. Farmers I interviewed in Siaya reported that, on average, they lacked sufficient quantities of their own maize to feed their families and had to supplement with additional maize bought at the market for approximately five months of the year. Poorer households with limited access to arable land (i.e., less than 0.4 hectares) reported up to seven months when they are deficient in maize. Butere farmers also reported a similar five-month period of food insecurity, which was associated with a need to buy maize. Due to these deficits, families often supplement their diet with alternative food crops, including sorghum, beans, cassava, finger millet and sweet potatoes, especially during the short rains.

Factors affecting land management techniques

Farmers in Butere and Siaya encounter many constraints when it comes to managing their land. Each has an impact on the evolution of the farming system and farmers' adaptability to changing conditions. Smallholder farmers are highly vulnerable to such shocks as adverse weather, plant diseases and changing market forces, and even a slight change in their expectations can be financially and economically devastating. These issues weigh heavily on their risk management strategies, as they decide whether or in

[27] Interview, female farmer, wealth category C, Khushiku, Butere, June 18, 2009.

what capacity to invest in a new technology based on the likelihood of obtaining a desired range of outcomes (Stirling, 2003).

This section outlines some of the main constraints and risks, both biophysical and economic/social, facing farmers in the research sites, as well as their coping mechanisms. It is based on extended interviews with men and women in the study area at different points in the growing seasons, as part of a series of semi-structured interviews and focus group discussions (see Chapter 2). The aim is to give an overview of the diverse factors influencing farming practices and, in particular, the ways in which agricultural inputs, such as hybrid seed and inorganic fertilisers, are incorporated into farming.

The research sites in Butere and Siaya Districts (Khwisero and Yala Divisions, respectively) are characterised by low to moderate soil fertility. According to previous surveys, soils have become degraded due to constant maize cultivation with little application of fertilisers, especially chemical fertilisers, to restore nutrients (GOK, 2002; Millennium Villages Project, 2005). Many farmers in this area have very low rates of fertiliser usage (13 percent), resulting in few nutrients being put back into the soil (Ariga et al., 2009). Maize farming is exclusively rainfed, therefore the weather and rainfall patterns have a large effect on yields. As Peter, a young well-off farmer from Butere, explained:

> *In 2009 and 2007, the climatic conditions really affected us because the rains just disappeared all of a sudden when the maize was flowering. Climatic conditions affect farmers currently because you cannot even bank on the rains when you are doing farming, if you bank on the rains, you are going to fail. Therefore, the weather is no longer reliable and I can no longer predict what will happen or what I can produce on the farm.*[28]

There is also a seasonal dimension to risk assessment when considering whether to purchase inputs for the long rains versus the short rains. The short rains are often too unpredictable and many farmers perceive an investment in improved inputs as too risky for that planting season. Dependency on the rains affects all levels of wealth categories. Emily, a well-off farmer from Butere, purchases improved seed and fertiliser for the

[28] Pseudonym used. Interview, male farmer, wealth category A, Khushiku, Butere, May 10, 2010.

long rains only, since the chances of a good return on her investment should be higher than during the short rains. She states:

> *For long rains I would buy fertiliser, but not for short rains. I feel fertiliser is a must to use in long rains. If I have money, I purchase 10 kilograms that covers about a quarter acre. Then I supplement the remaining of my fields with cow manure. However, for the short rains, I plant without anything. Why would I spend money on fertiliser and then the rains fail me?*[29]

Many plant diseases (e.g., maize streak virus, grey leaf blight and head smut) and pests (e.g., African maize stem borer, rats, moles, termites, weevils, squirrels and monkeys) are prevalent in the study areas. The most common problem mentioned was the excessive growth of *Striga hermonthica* (witchweed) (cf. Oswald, 2005; Kiptot et al., 2007; Vanlauwe et al., 2008). *Striga* is a parasitic weed that affects cereal crops, especially maize and sorghum. It attaches itself to the plant's roots and grows by stealing nutrients from the maize. *Striga* is often associated with poor soil fertility and a lack of soil moisture. Control mechanisms include intensive hoeing and weeding, but these are often ineffective (Manyong et al., 2008). Infestation by stem borers was the second most common complaint. The stem borer moth lays its eggs on maize leaves and the larvae chew into the stems and stalks, cutting the flow of nutrients to the plant (Vanlauwe et al., 2008). Both *Striga* and stem borer can drastically reduce yields and sometimes cause complete crop failure. Farmers' ability to overcome these risks are often linked to their social and economic standing and their access to knowledge and capital to adequately address these problems.

Figure 11: Farmer showing *Striga* (purple flowers) infestation on her fields, Butere, June 2010

[29] Pseudonym used. Interview, female farmer, wealth category C, Khushiku, Butere, June 15, 2009.

Once farmers harvest their maize crops, such economic factors as market price fluctuations affect the farming system. Maize prices are quite variable throughout the year, dropping at harvest and then increasing dramatically in the period just before the long rains (cf. De Groote H. et al., 2004; Barrett, 2008; Jayne et al., 2008; Ariga et al., 2010). Many factors cause this price variability. One of the major causes is the seasonality of maize production and the lack of adequate storage facilities at the household level (Komen et al., 2010:1231). Price variability affects farmers differently, depending on their wealth categories. For example, the majority of farmers in the lower wealth categories (95 percent) sell their maize just after harvest due to lack of storage capacity and the need for money to buy household goods, keeping little until the next planting season. These same farmers then buy maize from the markets at a higher price later in the season when their own supplies run out.

Farmers have many reasons to sell their maize at harvest. One reason revolves around problems with long-term storage. Post-harvest losses among smallholder farmers in Kenya are often very high (Giles and Ashman, 1971; Dobie, 1974; Nyambo, 1993; Oduor et al., 2000; Waithaka, 2010). Measures to offset post-harvest losses (e.g., timely harvesting, appropriate facilities to keep maize at a constant moisture content and application of 'dusting' with pesticides) require labour and capital that many poor smallholder farmers do not possess. In addition, harvest time typically coincides with high seasonal household expenses (e.g., school fees) when farmers have the least amount of money available. Consequently, many farmers are forced to sell maize at harvest, when the prices are lowest, to pay for urgent household expenses.

The wealthier farmers in the area, who have better storage facilities, are able to store the bulk of their maize until the price goes up. However, even these wealthier farmers reported that they suffered from heavy losses due to pests and theft. Without the ability to store maize adequately or safely, investing scarce resources into increasing production may not produce the return on investments that farmers expect. The wastage due to post-harvest losses and low prices achieved at harvest time may make it uneconomic to spend limited resources on improved inputs.

Furthermore, factors such as household composition, wealth, gender and labour availability can affect farmers' interactions with the market. For example, five female-headed older households (over the age of 55 years of age), in both middle and poorer wealth categories viewed their food security situation linked so tightly to the maize harvest that they reported using maize strictly for household consumption and did not sell their produce. As Claris, an older widow from Siaya, remarked:

> *I am not someone who can sell my maize. It is our custom; we do not sell maize.... If I sell my maize, I will have to buy it back later for a much higher price, then I am lost.*[30]

The availability of labour is a major issue affecting smallholder farmers' ability to invest in new technologies. The composition of the household is tied to the availability of labour to work the fields or to bring in an income from off-farm employment. The majority of farmers in Butere and Siaya rely on family labour to tend their farms. There are distinct gender roles based on power relationships within the household. The husband concentrates mostly on ploughing and sowing, while the wife, children and grandchildren focus on weeding and harvesting. A number of factors can limit access to household labour, including out-migration or health-related issues that affect people's ability to work the land. Therefore, farmers often rely on hired labour, assistance from relatives or, on rare occasions, assistance from community groups or church members.

Figure 12: A group of farmers working together to weed a field, June 2009, Siaya

[30] Pseudonym used. Interview, female farmer, wealth category B, Nyandiwa, Siaya, May 3, 2010.

More than half (55 percent) of the farmers interviewed reported hiring labour at some point to help with weeding or planting.[31] Labour from outside the household is often used for plots far from the homestead, or during times of crisis, such as illness. The labour market is therefore a means of mitigating against the risks of labour shortages within the family.

However, the ability of a household to hire labour is affected by its own demographic composition and its wealth status. Households in the highest income wealth category (77 percent) reported hiring labour to work on their fields. These wealthier households not only have larger plots of land (over two hectares), but also have more disposable income available from remittances supplied by family members working in neighbouring towns. Remittances from family and relatives working off-farm are an important income source for households at all levels in this area, and can be used to pay for labour and inputs. Farmers in Siaya and Butere mention a strong cultural tradition of sharing wealth with the family back in the village. Zadock, a middle-wealth category farmer from Butere, explained how he depends on remittance from his relatives to purchase inputs:

> *I tried fertiliser three years ago for the first time because that year I was lucky to get money from a relative in town. I decided to buy fertiliser since that relative supported me. I have not been able to purchase it since that time.*[32]

Within the middle-income wealth category, the labour results are more mixed, with 53 percent of those households stating that they regularly hire labour during the growing season to help with weeding, cultivation and harvesting. The majority (75 percent) of the poorest households state that the rate for hired labour is too high for them to afford. These households depend (almost exclusively) on family labour to work their fields and are less able to benefit from labour-intensive technologies. Yet, even within this wealth category, labour issues affect households disproportionately, depending on their household composition. For example, three elderly widows in Siaya mentioned that they are too old to work their land and so they depend on the assistance of family and,

[31] Data is based on a series of semi-structured interviews with 76 households based in the two research sites, between April 2009 and June 2010. See Chapter 2 and Annex A for overview of data collection.
[32] Interview, male farmer, wealth category B, Khwisero, Butere, August 12, 2009.

at times, hired help. Two poor widows mentioned that they often leave some parts of their fields fallow due to lack of labour to assist them in planting.

The effects of HIV/AIDS have compounded the labour issue, with the epidemic affecting the working-age population (ages 15-49) heavily. HIV/AIDS prevalence in Siaya is estimated to be close to 38 percent (GOK, 2005: 5). Estimated rates in Butere are put at roughly 14 percent (GOK, 2002: 24), but other health organisations assume these rates to be far higher (Thomas, 2004: 23). Loss of a large part of the active labour force has placed a heavy burden on those that remain on the farm, especially the elderly and young children, who are often unable to fend for themselves. Women are also disproportionately disadvantaged, since they usually have to care for sick and ailing family members, as well as providing the main source of labour for the farm and other livelihood activities (Aliber et al., 2004).

Overall, smallholder farmers in this area face a range of risk factors. From the biophysical factors of soil fertility, pests and diseases, to the economic factors of price, labour, landholdings and credit markets, these farmers must negotiate around these risks to develop a unique farming system. In so doing, these farmers construct changes based on their individual characteristics, which include wealth, access to land, labour supply, capital, social standing and cultural factors. The next section takes a closer look at some of the key social factors that affect the farmers' ability to incorporate new technologies into their farming practices.

Social structures and power relations affecting technology adoption

Social connections and access to knowledge shape people's understanding of their surroundings and affect their ability to take advantage of opportunities and adjust to changing conditions. According to Long and Villarreal (1993: 160):

> *Knowledge is essentially a social construction that results from, and is constantly reshaped by, the encounters and discontinuities that emerge at the point of intersection between actors' life-worlds [or social fields].*

Therefore, farmers depend on an array of different networks to gain or improve their knowledge of new farming techniques and soil improvement practices and to construct

their own socio-technical system. Moreover, it is at the intersection of social and technical factors that the process of technology adoption is co-constructed. As explained in Chapter 2, a whole set of negotiations take place at the social and technical interface (Long and van der Ploeg, 1988; Long, 1999). According to Long (2001: 243), social interface refers to:

> *... a critical point of intersection between life-worlds, social fields or levels of social organisations where social discontinuities, based upon discrepancies in values, interests, knowledge and power, are most likely to be located.*

Here, different narratives about agriculture, farming practices and technology interact, with narratives framed at the macro level intersecting with those constructed at the meso and local levels. The interface between local farming practices and project implementation is a major focus of the subsequent two chapters. These show how such encounters may lead to dissonance, misunderstandings and conflicts. How a farmer translates his/her knowledge about a technology into practical use will differ depending on their individual socio-technical setting and the social and political basis of their interactions with projects, project staff and the knowledge networks they draw upon.

Local knowledge and understanding about the state of the soil has a large influence on how a farmer manages their land. During a focus group in Siaya, participants discussed the different techniques they use to understand the state of their soil or why their fields are affected by pests and diseases.[33] They use the colour and feel of the soil as one of the indicators of soil health. Spencer, a retired teacher and well-off farmer from Butere, explains:

> *The soils on my fields vary a lot. Like down there by the road, that soil is different from what I have here in my home garden. This one is red, that one is almost brownish. The texture is very different. Therefore, I must use different seeds and different inputs. You see, I know much more about my soil than someone in Nairobi who wants to sell me some inputs.*[34]

Spencer exemplifies a well-off farmer who uses his larger plots of land to experiment with different crops and farming techniques to see what grows best in different portions

[33] Focus Group Meeting, Lihanda, Siaya, April 22, 2009.
[34] Pseudonym used. Interview, male farmer, wealth category A, Doho, Butere, May 14, 2010.

of his land. Due to his social connections within the community, he has benefited from previous training programmes and has travelled to different training centres for further instruction. Therefore, he uses both his on-farm experimentation and off-farming training to adapt and adjust his farming techniques based on the performance of the land and his knowledge of the soils.

However, not every farmer has these opportunities. Even when farmers are able to identify the changes in colour and texture of their soils, a common complaint is the lack of appropriate knowledge, labour and inputs to deal with these problems. This lack of knowledge is linked to a recurring complaint about the inadequate government extension services in the area. Extension services in Butere are understaffed and underfunded. This has led to frustration amongst extension officers in Khwisero, who complain that they have too large an area to cover with no means of transportation. One officer pointed at his broken bicycle and said:

> *This bicycle is my only means of transportation to cover all my sub-locations. It has been broken for months and I have no other way to travel. This means that most days I do not go out to the field and instead wait in my office for farmers to come to me.*[35]

The problem of underfunded and de-motivated extension officers is not unique to Khwisero and runs deeper than a broken bicycle. As mentioned in Chapter 4, the liberalisation period of the mid-1990s negatively affected the extension services in Kenya with large reductions in funding. The results are expressed today in the limited capacity of extension services to reach the intended beneficiaries. With little support and poor targeting from extension agents, smallholder farmers often rely on their community connections and social ties for information. However, access to these social networks depends on the class and wealth/power status of the individuals within the communities. For example, the wealthier and middle-income farmers in Butere possess strong community connections and social ties to the leaders in the community. These farmers are able to access information, through the local programme promoters or community connections, and benefit disproportionately compared to others without these strong networks. When programmes enter an area, farmers who are better connected to social networks, or in a position of power, are often the first to hear about

[35] Interview, Agriculture Extension Officer, Khwisero Division, Butere, June 18, 2009.

the programme and have an added advantage in terms of participation. Information on new technologies is often passed on through informal networks (such as family ties or relationships with the leadership of the village) or through direct participation in community functions, including *barazas* (public meetings), church functions, and other community activities. These added benefits often do not exist for farmers, especially women, who are on the fringes of the community and in the poorer wealth categories.

Melissa is one such poor widow from Butere, who feels that her poor wealth status in the community has directly affected her chances of participating in or benefiting from new technologies that are brought into the village. She is the sole provider for her six small children, her brother's child, plus another distantly related child. She rarely attends community meetings and has very little knowledge of what is happening in her community. She feels that her status within the community has affected her chance of participating in certain programmes, observing:

> *Even though many programmes have come into my area over the many years, I have not benefited from any programmes because I do not attend the community meetings. Sometimes when I attend a burial I hear that some assistance is coming, so I wait in my house to be told there is assistance but it does not reach me. I do not know why I am passed by when these programmes do outreach in the community.*[36]

Melissa goes on to explain that she feels she is left out of opportunities to learn about new technologies due in part to her lack of connections to local leaders. Therefore, she believes new technologies are denied to widows like herself. In her experience, the most vulnerable members of the community often miss opportunities for training and accessing new technologies because of limited outreach and improper programme targeting.

Alternatively, for farmers who are connected, their personal networks can prove to be a useful vehicle for access and knowledge and allow them to engage further with a programme's rollout. Moreover, because these networks extend beyond the community limits, farmers can often rely on external network contacts for information even when

[36] Pseudonym used. Series of interviews with female farmer from poorest wealth category, Emutsasa, Butere, May 2009 to June 2010.

programmes are outside their communities. In these instances, farmers are likely to benefit when knowledge is transferred from farmer to farmer.

However, integration into a programme is not the only route to knowledge and technology for poor households. Some poorer farmers described how they were introduced to improved inputs by working as paid labourers on other people's fields who had already adopted the technology. For example, for Monika, a poor farmer in Butere, her first encounter with fertiliser was through working on another farmer's land where the technology was already in use. Monika describes how she first learned about fertiliser:

> *When I worked in other farms, I saw how good their farms were and that they were using fertiliser. I had not used fertiliser before but I discovered that fertiliser was important for the soils so I decided to try it. Now, if I have money after working, I buy a little bit of fertiliser – on average I buy 15 kilograms of fertiliser and mix it with compost from my household rubbish.*[37]

The movement of labour, within and outside the region, affects local knowledge transfer about new technologies. This is especially true for Butere, where many people work on commercial farms (e.g. sugarcane). Several have learned about fertiliser by working in the areas that have a high rate of technology adoption. The mobility of workers has helped to bring back information and knowledge. For example, Jane, a poor farmer from Emutsasa Sub-location, explains how her husband Ernest used to spend a lot of time working on the commercial farms within Butere. She explains:

> *I started using fertiliser in 2005. My husband used to travel a lot to work in other districts on some big farms. It was through these visits and travelling that he learned the importance of fertilisers. He would send me some money and tell me to buy some fertiliser.*[38]

Farmer-to-farmer knowledge exchange is very common in the study areas. Farmers learn by watching their neighbours or by working alongside other farmers. Farmers are more willing to replicate successful farming practices, when they have seen them working, especially if the adopting farmer is doing better than they are. In this way, farmers experiment with new technology and planting methods in consultation with

[37] Pseudonym used. Interview, female farmer, wealth category C, Doho, Butere, August 28, 2009.
[38] Pseudonym used. Interview, female farmer, wealth category C, Emutsasa, Butere, August 28, 2009

other farmers in their social network. Farmers who did not have access to these social networks learned about new technologies in a more informal and varied way.

This section has shown that the process and outcomes of knowledge are shaped by the interaction of power, authority and access to resources that are available to different actors. Long coined the analysis of these processes the interface of knowledge. According to Long (2001: 191):

> *Studies of interface encounters aim to bring out the types of discontinuities that exist and the dynamic and emergent character of the struggles and interaction that take place, showing how actors' goals, perceptions, values, interests and relationships are reinforced or reshaped by this process.*

In addition, according to Röling (1988: 4), the exchange or diffusion of knowledge about a new technology can "only take place within a 'population' of intended utilisers who face similar production conditions." Therefore, knowledge exchange about an innovation or new technology among only a few people may not diffuse to everyone in the community. To promote successful diffusion of knowledge, "extension must often focus on mobilising farmers and on creating organisations for delivering or utilising technology" (Röling, 1988: 4). Therefore, through a closer examination of these social networks at the micro level, this research focuses on:

> *... the interplay of different social constructions of 'reality' development by various parties to the interface (e.g., government bureaucrats, peasant farmers and traders) and traces out their social implications* (Long, 2001: 191).

This actor-oriented approach is a useful tool to shed light on the creation, dissemination and transformation of knowledge at the local level. The next section takes a closer look at these transformations of knowledge at the interface between different technologies and the realities of farming and social constructions.

Integrating soil management practices: Developing niches to manage constraints

While the previous section described the physical, economic and social factors that frame the farming system in general, this section outlines the range of soil management

practices used by farmers in Western Kenya, and adapted to innovative niches in their efforts to overcome physical, biological and capital constraints (Moors et al., 2004). Again, this section is based on a series of semi-structured interviews and focus group discussions (see Chapter 2 for methodology). It describes how soil management practices may or may not become embedded in specific local social systems and how their adoption is affected by social standing and gender. It also highlights how innovation systems change when people experiment, adapt or distance themselves from technologies. It goes into detail on the ways in which farmers appropriate ideas and adapt them to their own circumstances.

While a range of soil management strategies exists, this section highlights four main technologies that have been introduced into the research sites over time: (i) fallow management; (ii) composting; (iii) bean intercropping; and (iv) agroforestry. Each section touches on some of the factors that have influenced the evolution of these practices, highlighting some of the main constraints (e.g., land, assets, markets and labour) that have shaped local soil management strategies and helped to define the local socio-technical systems.

Fallow management techniques and conflicting land constraints

As previously highlighted, declining soil fertility is a major constraint for farmers in the research sites. Continuous cultivation of farmland has become a recent imperative in Western Kenya due to high population densities and increasing pressure on the land (Omamo et al., 2002; Tittonell et al., 2007). In the past, it was common to leave land uncultivated, or fallow, for a period to help replenish soil nutrients (Barrow, 1989; Kariaga, 2004). Interviewed farmers still believe this is the best way to restore soil fertility. However, the practice of fallowing has decreased considerably in both Siaya and Butere due to the rising population and decreasing landholding area per household (Kiptot et al., 2007).

Lack of farmland is a critical issue in both study sites. With limited land available, fallow systems are *ad hoc* and inconsistent. According to the interviews, farmers who practise fallow systems on a more continuous basis are better off and have access to additional land for cultivation (averaging greater than two hectares). Most farmers (80

percent) with small land sizes (less than 0.4 hectare) are unable to leave land idle on a continuous basis. This is especially true if they had a poor harvest during the long rains, forcing them to plant maize again during the short rains to make up for a low yield. Two of the poorer farmers who had less than 0.4 hectare described how they would leave small portions of their land fallow; however this was due more to external constraints, such as lack of labour or financial capital, and less to soil management techniques. Farmers with slightly larger land plots, on average 0.4–1 hectares, reported leaving small portions of their land fallow during the short rains, especially those parts that had not performed well during the previous long rains. Yet, the consistency of using fallows varied across the households and depended on the amount of maize harvested during the long rains.

Farmers like Helen from Siaya understand that continuous planting has a detrimental effect on soil fertility and may perpetuate the problem of low yield. However, low maize yields and lack of available farmland make it difficult to do otherwise. Helen is a young widow in Nyandiwa sub-location, Siaya District. She has 0.4 hectares of land, which must sustain her and four young children. Farming is her only source of food and income. She knows how much food her children require for the year so she makes her calculations on what and how to plant based on a number of important factors, such as previous yields from the long rains harvest. As she explains:

> *If my harvest in the long rains is good, and I can get six or seven bags of maize, then I do not plant maize in the short rains. However, if I get less than that I have no choice and I will plant maize again.*[39]

Helen's choices on what and when to plant are vital determinants of the health and food security of her family. She admits that most times she does not harvest enough on her small plot of land to keep her family fed throughout the year. Without improved inputs, such as hybrid seed or inorganic fertiliser, her highest yield is around two bags (180 kilograms) of maize. This is not enough to feed her family. Therefore, she depends on the two growing seasons to produce maize. Even though she harvests twice, she still must buy maize for her family for 4–5 months of the year. She depends on her income from working on other people's farms to make ends meet.

[39] Pseudonym used. Series of interviews with female farmer from poorest wealth category, Nyandiwa, Butere, May 2009 – June 2010

Helen's story demonstrates how one young widow is faced with both land and labour scarcity and how these shape her farming decisions. Therefore, her decisions to invest in soil management techniques are based on a careful analysis of how much food she needs to feed her family for the year. The two planting seasons become intricately connected and the decision to practice land management techniques, such as fallowing, becomes a question of her relative food security risks and how she is able to manage those uncertainties.[40] Her limited access to land and additional labour highlights her socio-economic standing in the community and severely affects her ability to adapt her farming techniques to include alternative practices – leaving her in a continuous cycle of decreasing productivity and increasing poverty. Therefore, the introduction of any new systems or technologies must take into account these constraints, offset risks, and allow the farmers to adapt the technologies to fit their specific socio-economic circumstances.

Composting strategies and overcoming asset constraints

Another very common method of soil fertility management is the use of *boma* (farmyard) manure and pit composting. These two methods have been practised in this area for many decades as a technique to replenish soil fertility. Both technologies have been promoted by the government at different times from as early as the 1930s (Mackenzie, 1991: 237; Onduru et al., 1999: 4). Initially the farmers rapidly adopted *boma* manure, but pit composting was much slower to take hold and was not sustained due to the availability of manure, which was cheaper and easier to manage. However, pit composting was reintroduced in the 1960s and promoted vigorously in the 1980s by NGOs and other institutions endorsing 'sustainable agriculture' (Tiffen et al., 1994; Onduru et al., 1999; Hilhorst et al., 2000).

[40] See Tripp (2006) for discussions on how low-external-input technologies are in many respects not different to other Green Revolution high-input technologies such as hybrid seed and inorganic fertilisers. Both forms of technology (low-external-input versus high input) often require significant amounts of labour, commitment and additional skills to be employed. Therefore, Tripp advocates for a more detailed understanding of the unique and diverse challenges facing individual farming households to ensure a wider range of technological choice to meet the diversity of needs of highly differentiated farming communities.

People mentioned using different methods of composting on their farms. Pit composting involves filling a pit with vegetation, such as maize stalks or cuttings from hedges and other green manure. This is covered with a layer of animal manure or some previously made compost and a layer of topsoil to cover the pit. Farmers also add kitchen waste and green cuttings, such as weeds, grass and hedge cuttings. They cover this with more top soil or with ash from their fires. These layers are then repeated. Then the pile is watered and mixed every few weeks until the compost is ready, usually after about two months. It is commonly used in the fields closest to the house and the vegetable gardens outside the kitchen, as it is labour intensive to carry the compost further from the home. As Jane, a poor widow from Doho Sub-location, explains:

> *Before 2007, I used only to make compost on the farm. This came mostly from my household waste, as I have no animals. It would not be enough for my one-acre plot so I would put some closer to my home garden and the rest I would plant without anything. I could usually get about one to two bags of maize.*

Jane goes on to explain the results she now gets when she incorporates composting with a bit of inorganic fertiliser:

> *However, for the past three years, I aim to buy a little fertiliser, like last year I bought 15 kilograms, and I mixed it with my compost. I harvested seven bags of maize. This was the highest yield I ever received.*[41]

Boma manure is another type of compost, made from animal manure, including cow, sheep, goat, chicken or rabbit, which is mixed with a bedding of maize stalks, grass, leaves, ashes, weeds and other material. This mixture is sometimes combined with the compost manure in the method described above. However, a farmer's ability to make *boma* compost manure is dependent on their access to animal manure. In Butere, 90 percent of the households interviewed used *boma* manure combined with either compost or small amounts of inorganic fertiliser.[42] Only eight percent of Butere households did not use *boma* manure and depended exclusively on compost made from household waste. In Siaya, the number of interviewed farmers that used *boma* manure was much lower and only 64 percent of the farmers discussed using *boma* manure. Approximately 36 percent of farmers interviewed in Siaya did not use any *boma*

[41] Pseudonym used. Interview, female farmer, wealth category C, Doho, Butere, June 24, 2009.
[42] As mentioned at the beginning of this chapter, this data is based on semi-structured interviews with 76 households and a series of focus groups within the two research sites. See Chapter 2 for further detail.

manure and relied only on composting. The main reason cited for not using *boma* manure was the lack of livestock.

Therefore, using *boma* manure in Butere is more prevalent due to the higher concentration of livestock. While in Siaya, composting (and green manure – discussed later) is more common, due to fewer livestock and the long-term presence of NGOs and international agricultural research institutes (such as the World Agroforestry Centre) that focused on alternative soil management techniques in the area well before the MVP programme was launched.

Intercropping and the importance of markets

Planting beans in between maize lines is a common practice in the study sites and has been documented for many years in Western Kenya (Mango and Hebinck, 2004; Kiptot et al., 2007). Beans are grown largely for subsistence and are a major source of protein (Katungi et al., 2009; Mucheru-Muna et al., 2010). They are an important component of household-level food security for farmers in Butere and Siaya, especially when maize harvests are inadequate. The traditional method of planting maize and beans is through 'broadcasting' the seeds by hand (Mango, 2002). In this method of planting, seed is thrown by hand and then covered using a hoe. However, this technique has been replaced over the years by intercropping of maize and beans in lines, a technique introduced by several government and NGO programmes.

The benefits of intercropping include less erosion and leaching, weed control, pest management, nitrogen fixation, provision of green manure, soil coverage, and increased food security (cf. Odhiambo and Ariga, 2001; Woomer et al., 2004; Okoth and Siamento, 2010; van Wolfswinkel, 2010). However, farmers differed in the way they adapted the knowledge to fit within their current context. While farmers in Siaya mentioned the benefits of beans in improving soil fertility and control of *Striga,* the majority of farmers did not list soil fertility as their top reason for intercropping maize and beans. Instead, farmers described how they adopted intercropping techniques because of the growing population competing for land. However, at least 50 percent of households considered intercropping to be a method of soil fertility management and weed control. The households in Siaya often referred to programmes from the World

Agroforestry Centre that had been in the area for the past decade and focused on training farmers on different techniques to improve the fertility of their soils. Yet, the top reason for intercropping for Siaya farmers still remains a question of land scarcity foremost, and soil fertility management as a secondary and added benefit.

Intercropping maize and beans has an additional value to farmers that directly affects their food security situation. In addition to being a good source of protein, farmers use beans as a cash crop. Many of the households, especially the female-headed ones, rely on the sale of beans to pay for household expenses. Due to the high market value of the bean crop in Butere, farmers emphasised the benefits of the bean harvest for improving household income. Therefore, their farming system has developed a strong focus on bean production due to market demands. Musa, the Farmer Rep for Doho Sub-location in Butere, explained:

Figure 13: Farmer getting her beans ready for market, Butere

> *Farmers in this region continue to broadcast beans because farmers felt that planting beans in rows could affect the quantity of the bean yield. Here in Khwisero, beans tend to fetch a higher price and many households sell beans to help with their household incomes. Our neighbours in Siaya are taught to plant the beans in rows by Millennium, but here it will not work. The beans in Butere will get you a better price in the market, so we will continue to broadcast our beans as we have been doing. It does not make sense to change that custom.*[43]

This farming practice evolved in Butere to ensure a higher yield of beans since many farmers depended on the sale of beans to earn income to support their families. Therefore, the effects of the markets and the price that farmers can get from products had a direct effect on the evolution of the system. The availability of reliable output

[43] Interview, Farmer Representative, Kisa West, Doho, Butere, May 13, 2010.

markets to sell their produce is an important consideration in farmers' decision-making processes when they consider investing in improved agricultural inputs. Programmes that introduce new technologies into a given locality must therefore understand the local economic conditions that embrace that specific farming area.

Agroforestry techniques and labour constraints

Several organisations, including the World Agroforestry Centre, KARI, and the Kenya Forestry Research Institute (KEFRI) have attempted to introduce agroforestry into Siaya and Butere as a means of addressing declining soil fertility (Rao and Mathuva, 2000; Odame et al., 2003; De Groote et al., 2005). Improved fallows and biomass transfers using fallow trees are the two most successful technologies introduced (Place et al., 2005). The two tree systems were introduced in the area between 1997 and 1999 and initial adoption was good. However, since then, many farmers have stopped planting them (Place et al., 2005). This is due in part to high labour requirements and difficulties in obtaining good quality seedlings (Place et al., 2005). Both systems are labour-intensive; tree fallow systems require manual removal of trees from the field, while biomass transfer systems need labour to cut, carry, spread and incorporate the biomass in the fields. In addition, small farm sizes preclude the use of tree fallows as they cannot grow enough to justify the amount of labour needed.

Within the research sites, trees are used for timber, firewood and boundary planting. Smaller shrubs – including the species introduced under the agroforestry biomass system – are planted mostly on field boundaries. Farmers mentioned the benefits of trees for firewood, setting the boundary of their compounds or to keep cattle out of their fields, but biomass transfer was not discussed as a means of addressing soil fertility. Therefore, even though the fallow tree species introduced in this area worked well to improve soil health, real life constraints including labour shortages and small land sizes are enough to make the system unsustainable in the longer term. Farmers have changed their use of the tree crops to fit their socio-economic realities.

Weighing up the costs

These four examples of soil management technologies (fallow management, composting, intercropping and agroforestry) suggest that the benefits of new technologies need to be weighed against the costs of adoption in particular settings. Farmers may experiment, adapt and appropriate ideas from outside, such as new sowing patterns and multipurpose tree species, but they always adapt these technologies to their particular socio-technical circumstances. Even when farmers see a value in a technology, their ability to continue use of that technology is affected greatly by the local social, economic and ecological factors that shape their socio-technical context and their own personal needs and capacities.

These four examples demonstrate that adoption of a technology is not straightforward. There are many reasons why people do or do not incorporate the technology into their farming repertoire, and so embed it within the knowledge, politics and institutional arrangements that make up the socio-technical system. Thus, in negotiations around technologies for soil fertility management in the study sites, the four examples show how a particular narrative of soil fertility management pushed by external actors – around agroforestry and biomass transfer for organic matter management – while technically sound, was not appropriate to the local contexts. The result was that in the encounters between local farmers and external actors (in this case NGOs and the World Agroforestry Centre), technologies and their application were transformed in ways that the external players had not envisaged. Farmers experimented and developed particular niches to fit with their own realities. For example, trees were incorporated for different reasons since farmers could not afford the labour or the farm space for the technological designs proposed.

In this fashion, new socio-technical configurations were created through 'performance knowledge'[44] as farmers experimented with the technologies over time (Richards, 1989, 1993). This experimentation followed from the 'knowledge encounters' created by interactions with the projects of the 1980s and 1990s (cf. Long and Long, 1992). The

[44] According to Richards (1993), farming performance or 'performance knowledge' is not a design but a result of experimentation by the farmer at a given time. Therefore, what transpired, and why, "can only be interpreted by reconstructing the sequence of events in time. Each mixture is a historical record of what happened to a specific farmer on a specific piece of land in a specific year" (Richards, 1993: 67).

result today, as observed in the field during this research, is a very particular and novel configuration of social and technical practice, as a response to a series of constraints and the on-going pressure of soil fertility decline. The following section turns more specifically to an examination of local adaptation and contesting strategies surrounding hybrid seed and inorganic fertilisers: two technologies that are central to the Green Revolution narrative and that are at the core of the two case studies that follow.

Farmers' responses to seed and fertiliser interventions

Having shown how smallholders respond to soil fertility problems in various ways, this section touches directly on the social and institutional factors affecting farmers' interactions with hybrid seed and fertiliser technology packages. It highlights some of the channels through which farmers deal with the introduction of new technologies and the methods they employ to adapt or reject these new systems and knowledge, within the context of multiple risks and vulnerabilities (Chambers et al., 1989; Scoones and Thompson, 2009).

Farmer-owned strategies for maize seed selection

Many of the input-support packages offered to farmers in development programmes in Kenya contain both inorganic fertiliser and hybrid maize seed together. The type of seed offered is of great importance to the farmer, as it must not only grow well in the ecological conditions of the specific area, but also conform to the preferences of the farmers themselves. Many documents have been written concerning maize seed selection in Siaya District (cf. Cohen and Atieno Odhiambo, 1989; Mango, 2002; Mango and Hebinck, 2004). Mango's research highlights the evolution of the maize landscape in Siaya as:

> *...different social processes, repertoires, experiences and commitments, and resonates with different bodies of knowledge.... in which maize is selected, bred, multiplied and exchanged* (Mango, 2002: 290).

For example, he found that farmers base their seed selection primarily on taste, tradition, cost and performance. With both hybrid and local maize seed, the farmers

rely on their knowledge, community interactions (i.e., cultural repertoires) and sometimes on extension advice to select the seed.

By looking at maize selection through a socio-technical lens, Mango demonstrates the way in which the selection and use of local maize varieties are embedded in local knowledge, shaped by local cultural repertoires, and passed on from one generation to another. He concludes that the evolution of the socio-technical system around maize selection in Siaya ensures the predominance of local seed varieties. Hybrid maize seed was introduced into the region but it has never managed to completely replace local varieties.

My research supports Mango's findings. Out of the 72 farmers interviewed, only 53 percent purchased hybrid seed. However, issues of price, availability and financial constraints impeded the ability of farmers to purchase hybrid seed regularly. Anton, a young farmer from Siaya, described the competing priorities in this way:

> *I do see the difference that hybrid seed and fertiliser makes on my yield but I can only budget for it when it is close to planting time. Other priorities take precedence over these inputs. In my daily expenses and savings, the purchase of household items is prioritised above these because my young children cannot take porridge without sugar. Therefore, things such as inorganic fertiliser and hybrid seed are only budgeted for when it comes to planting time.*[45]

Even among those who purchased hybrid seed, there was always a portion of land reserved for local maize seed. There are many reasons why farmers prefer local seed varieties. Ibrahim, a middle-wealth farmer from Doho, cites the difference in the resilience of local maize to local conditions and pests. He explains his disappointment with the performance of the hybrid seeds versus that of the local seed, citing lower yields when compared with the local varieties:

> *When I use my local seed I know I will get a good harvest, but when I use hybrid seed the yield is much worse. I tried hybrid seed once but the yield was not good. So even if I purchase the hybrid seed, I must also always plant my local seed, the white local maize variety.*[46]

[45] Interview, male farmer, wealth category B, Nyandiwa, Siaya, interview, May 7, 2010.
[46] Interview, male farmer, wealth category B, Doho, Butere, June 22, 2009.

Farmers also discussed their preference for the taste and cooking quality of local maize. Florence, a middle-wealth widow from Siaya, dislikes the texture, flavour and weight of hybrid maize:

> *The problem with hybrid maize is that it is so light that the six bags I harvest are consumed within three to four months. Not like the local maize that is much heavier. Even the maize flour is heavier and makes for a better meal for my family. Therefore, I focus on the local seed to feed my family.*[47]

Failure of seeds to perform properly can be due to a number of reasons, including adverse weather, but are especially devastating for poor smallholders who rely on the harvest to feed their families. Grace, a poor elderly widow from Butere, describes how she mitigates against the risk of one seed variety failing by planting different types:

> *I plant maize twice a year because my production is not sufficient. I will buy hybrid seeds, but I always try a different variety from Pioneer, Western or Kenyan Seed Company. I buy only a few packages of different seeds, what I can get at the shop, and then I must supplement with my local maize seed and a bit of millet.*[48]

In diversifying the type of seed she plants, Grace is not only experimenting with different varieties to see how they will perform, but also spreading the risk of a total crop failure. Grace believes that adverse weather conditions affect the hybrids differently. She goes on to explain that she always plants a portion of her plot with local maize, as she feels this gives her the greatest security and she can harvest this maize earlier than the hybrid varieties. The local variety is used as a stopgap in farmers' household food-security strategies, since it can feed the family during times of hunger just before the main harvest.

Most importantly, the relatively high price of hybrid seed makes it unaffordable for some, and those short of cash will save some of the maize they grow to plant in the following season. Risper, an elderly farmer from Siaya, sees the high price of improved maize seed as a major constraint to continued use of the technology. She argues that she must always plant with her own seed, as it is her custom, and she will only buy hybrid if she has enough money to buy the hybrid seed together with inorganic fertilisers. An

[47] Interview, female farmer, wealth category B, Lihanda, Siaya, April 26, 2010.
[48] Interview, female farmer, wealth category C, Khushiku, Butere, June 18, 2009.

extension officer taught Risper that hybrid seeds require inorganic fertiliser to perform well and therefore she feels that she would be wasting her efforts if she purchased one without the other. Peter, a local agricultural-input shop owner in Khushiku Sub-location in Butere, confirms this view:

> *It is very rare to find a farmer who buys seeds and not DAP [di-ammonium phosphate] because there is a belief among most people here that if you buy hybrid maize seed then you must have DAP. However, if you plant the local seed it is believed you may even plant without any DAP.*[49]

These experiences demonstrate that many factors influence a farmer's decision to purchase hybrid seed or to continue planting the local varieties. Seed selection strategies are embedded intrinsically in farmers' social networks and cultural practices, and linked to accessibility to such resources as land, labour and financial means. Farmers thus negotiate and reconfigure their relationships to ensure they have access to social networks as an access point to technologies. In addition, local preferences regarding taste, seed price, and the resilience of hybrid seed to local ecological conditions are important factors influencing adoption of technology packages. Therefore, standard seed packages that exist outside these preferences and realities are not in tune with the local circumstances. Farmers will continue to adjust or redesign the package in multiple ways to fit their conditions, customs and practices (Mango, 2002). The result is multiple configurations of social and technical elements that are co-constructed over time and in relation to different wealth groups and social networks.

Incorporating inorganic fertiliser

When hybrid maize seed is packaged with inorganic fertiliser, the official recommendation from the Ministry of Agriculture is 75 kilograms of nitrogen per hectare (FURP/KARI, 1994). This is translated into 50 kilograms of inorganic fertiliser (e.g., di-ammonium phosphate (DAP), the most commonly used fertiliser in Western Kenya) per acre (0.4 hectare) applied when planting. The application rate is supported by government extension officers and based on agronomic optimum rates determined on research station sites through KARI trials (KARI, 1994). These application rates have become a benchmark for many input-support programmes incorporating inorganic fertilisers.

[49] Interview, Agro-dealer, Khushiku, Butere, May 10, 2010.

In some ways, Kenya is heralded as a success story for its high use of inorganic fertiliser compared to most other African countries (Ariga and Jayne, 2006; Ariga et al., 2009). However, this success is not uniform across the country, with different levels of uptake in high- and low-potential areas (Freeman and Omiti, 2003). A report by Ariga and Jayne (2006: 17), found that between 1996/97 and 2003/04, the proportion of Kenyan households using fertiliser rose from 57 to 74 percent in the Western Highlands (e.g., Vihiga and Kisii), but stayed at around eight percent in the Western Lowlands and Nyanza (including Siaya and lower Butere).

These low adoption rates can be related to various factors, including highly variable rainfall patterns, inefficient input distribution and lack of adequate returns on yields after fertiliser usage (Rao and Mathuva, 2000; Freeman and Omiti, 2003). A report by Anderson (1992) states that farmers' decisions to use fertilisers were based on the risks associated with their resource constraints and whether it was more profitable or not to use fertiliser than existing practices of soil fertility management (i.e., compost or manure).

The price at which farmers buy fertilisers is relatively high due partly to high transport costs. For example, Mose (1997: 5) found that in Western Kenya, average farm-gate fertiliser price for DAP was roughly US$475 per tonne, compared to roughly US$350 for most African countries and US$250 per tonne in other parts of the world at that time. Due to the high cost, farmers tend to alter the recommended application package, based on the realities of their economic situation. Farmers in both research sites buy fertiliser from small agro-dealers in different quantities, ranging from as little as 1–2 kilograms up to 50 kilograms bags. However, it is more expensive per kilo to buy a smaller quantity.

For example, Angela, a middle-wealth widow from Siaya, explains her difficulty in purchasing inorganic fertilisers. Angela lives with her four youngest children, five grandchildren and two orphan children from her late brother-in-law. She depends on her small plot (0.4 hectares) to feed her family and receives additional income from the sale of vegetables, bananas and sweet potatoes from her home garden. However, this is not sufficient to meet the expenses of school fees, food and clothing for the children.

Therefore, she depends heavily on remittances sent from her uncle and brothers working in a neighbouring town.

In 2009, her uncle sent money so she could purchase 10 kilograms of DAP at Ksh 750 (roughly US$10). She knew that the government was selling subsidised fertiliser through the National Cereal and Produce Board (NCPB) at Ksh 2,500 (US$32) for a 50 kilogram bag. Yet, Angela could not afford to buy the entire 50 kilogram bag. By purchasing a smaller quantity from her local agro-dealer, Angela knows that she was paying Ksh 3,750 (roughly US$49), an additional 50 percent for repackaging the fertiliser. However, she continues to purchase the higher priced fertiliser because she believes that she must use fertiliser. Therefore, in 2010, she asked her brother to send money so she could purchase another 10 kilograms of DAP from the local market.

Angela explains that while small quantities of fertiliser are relatively expensive, her financial constraints make it difficult to buy an entire bag. Nonetheless, she remains determined to purchase inputs for her farm:

> *I know that I cannot keep asking my uncles and brothers for money to help my farm. However, I will keep trying despite the difficulties I face. All I can do is hope for the best, and if luck is on my side then I will be able to make better long-term plans.*[50]

Angela's experience is substantiated by a report by Mose (1997: 5) who found that, on average, the price per kilogram was 29 percent higher for small quantities of non-subsidised fertiliser than an unopened 50 kilograms bag sold (non-subsidised) at the market. Agro-dealers in Siaya and Butere acknowledged that they sold more fertiliser in small packages than in the original 50 kilogram bags supplied by fertiliser companies. This is especially true just prior to the planting season, when some shops increase the price due to increased demand and limited supply. Agro-dealers explained that limited financial and physical capacity prevented them from stocking sufficient quantities of inputs at the times when they are most needed by the farmers.

Once farmers have purchased their inputs, they often redesign the application method to fit their needs and financial realities. For example, Joseph is a young middle-income

[50] Series of interviews with female farmer from wealth category B, Siaya, May 2009 – June 2010.

farmer from Butere who farms on 1 hectare of land. He started using DAP in 2005 but is unable to purchase enough to use the application rates recommended by the local extension officer. Therefore, he reduces the quantity to 25 kilograms of DAP per 0.4 hectare and supplements his application with animal manure or compost from household kitchen waste. While Joseph applies less than is recommended, he feels that buying fertiliser is important and he views farming as a long-term investment for the future of his family:

> *I like to make farming a business. I will continue with farming until I can start a business like a posho (mill) or a kiosk (store), to make sure I have enough food and to take the children to school. I feel I have not succeeded in farming until I get to start that business, which will come from the support of the farm. So now, I use money from my boda-boda (bicycle taxi) business to buy fertiliser. It is not enough, but you have to think ahead to see what you can do.*[51]

Respondents also mentioned that they do not apply inorganic fertiliser evenly across their different plots of land, focusing instead on certain areas of higher-value crops. These decisions are based on their experience and knowledge and include factors like the condition of the soil, prevalence of such weeds as *Striga*, slope of the field and presence of water. The proximity of the land to the homestead is also important, since closer fields tend to receive more compost than the further fields. Access to labour, especially for weeding, is a constant constraint and farmers tend to resist techniques that are more labour-intensive.

Farmers also hold beliefs about the effects of inorganic fertiliser based on their perceptions and experiences. One common fear is that excessive use of fertiliser (especially DAP) will increase the acidity of the soil. One village elder from Emwaniro Village in Butere explains:

> *Farmers were using DAP but it has made the soils acidic because after some years they are not getting good yields and so we are advising farmers to add animal manure or compost, if you do not have money you can just use animal manure.*[52]

[51] Interview, male farmer, wealth category B, Doho, Butere, June 23, 2009.
[52] Interview, Village Elder, Emwaniro Village, Emutsasa, May 18, 2010

Farmers also blame the increased acidity caused by excessive use of fertiliser for the increase in *Striga*. While *Striga* is more often associated with low fertility, some farmers interviewed believe that weeds, including *Striga*, are harder to control when inorganic fertilisers are used.

In a similar view, farmers also report that, since fertilisers increase weed growth, they have an associated and increased labour cost for weeding. For farmers with limited labour, this is another burden caused by the inorganic fertilisers. Farmers also mention that heavy fertiliser use can result in a hard pan in the lower part of the soil, making it more difficult to cultivate fields and reducing the yield. Others mentioned that fertiliser can 'burn' the plants if applied when rains are insufficient.

There are also worries that soils may get 'too used to fertiliser' and that once they start using fertiliser their fields will get 'addicted' to the inputs and will require continual application, otherwise yields will decrease drastically. Farmers fear that trying fertiliser just once would lead to an annual commitment to purchase expensive inputs. This fear prevented several farmers from experimenting with fertiliser.

The land tenure system is another important determinant, since tenant farmers are hesitant to use fertiliser if their long-term access to the land is not secure. Access to land is becoming an increasingly important issue in Kenya, especially within the two research sites that represent some of the most densely populated areas in the country (see Chapter 2). Land sizes have been dwindling gradually due to population growth and the custom of subdividing paternal homesteads amongst the wives and sons of the household (Haugerud, 1989; Shipton, 1992; Mango, 2002). While Kenya's written law does not discriminate against women, this customary practice of subdividing the land means that women have 'usufruct' rights (usage rights versus legal title) over the land through their husband and they have no right to sell or rent the property (Njuguna and Baya, 1999). Therefore, cultural practices, gender relations and land tenure issues come together to affect farmers' interactions with technologies.

Finally, some households rejected hybrid seed and fertilisers completely. For example, Joyce, an elderly widow from Butere, who is representative of the poorest farmers, has never used inorganic fertiliser. She states:

> *I use only my local seed and I plant without any fertiliser. I do not buy fertiliser since I know it is not for the local seed, it is for the hybrid seed. Therefore, I did not need to use it and I do not have the pesa [money]. Even if I were to save money, then I have to buy sugar first, since I cannot take tea without sugar.*[53]

Joyce's comments about lack of money and competing priorities was a common constraint voiced by farmers. The amount of disposable income is an important indicator that shapes a household's ability to purchase and use improved inputs. However, there are competing household priorities for this limited financing. The three top household priorities stated by farmers in both Butere and Siaya are health, education and purchase of household food and other items. Once these household concerns are dealt with, the extent to which farmers can purchase inputs is dependent on their disposable income and labour supply at the start of the long rains planting season. Therefore, the quantity of input purchased varies over the years and is influenced by many household priorities that compete for the limited resources.

This section has explored some of the social and institutional factors affecting farmers' interactions with hybrid seed and fertiliser technology packages. It highlights some of the channels through which farmers deal with the introduction of new technologies and the methods they use to adapt or contest them. It shows that farmers' seed and fertiliser use are influenced by a range of socio-economic, political and institutional factors and shaped by multiple risks and vulnerabilities. These risks change over time as farmers adapt and contest new technologies and are important elements in shaping each unique farming system. The resulting socio-technical systems are neither stable nor linear, and consist of dynamic interactions with the various elements within the system, differentiated by wealth, location and gender.

Conclusion

This chapter shows the dynamic and shifting nature of farmers' relationships with Green Revolution technologies as farmers interact with the many social, institutional and economic factors that surround the use of improved inputs. Farmers must consider a range of aspects, including agronomic and ecological factors, unfavourable market

[53] Pseudonym used. Interview, female farmer, wealth category C, Doho, Butere, June 24, 2009.

conditions, and other competing household priorities (such as health and education needs) before they decide whether or not investing in hybrid seed and inorganic fertilisers is economic, profitable and sustainable. They adjust their strategies and expectations over time as they interact with changing social networks and through experimentation and learning (Wiskerke, 2003). It is in these evolving niches, based on the farmers' own evolving strategies, that new socio-technical configurations develop (Geels, 2002; Geels and Kemp, 2007). Therefore, programmes that introduce new seed varieties must take into account local preferences of taste, the price of the seed, the resilience of the seed to local ecological conditions and the requirements of different kinds of farming households, and expect the intervention to change in the hands of diverse, experimenting farmers.

The chapter also demonstrates how intermediary factors (e.g., actors, organisations and social networks) affect the adoption and sustained use of agricultural technologies. The selection of inputs is rooted intrinsically in the local household economy and associated social network, since these influence access to such key resources as land, labour and capital. Furthermore, the research highlights how farmers' vulnerabilities to shocks are important determinants of their interaction with any new technology. Farmers will thus continue to adjust or redesign the package to fit their unique conditions, customs and practices. Therefore, the long-term outcomes that result from introducing improved agricultural inputs, such as hybrid seed and inorganic fertilisers, need to be understood within the wider context of improving the food security situation, and the multiple dimensions of risk and vulnerability discussed throughout this chapter. These socio-economic realities on the ground affect farmers' decisions on resource allocations and investments, and ultimately shape farmers' interactions with new agricultural technologies.

Furthermore, a deeper appreciation of these local socio-technical realities needs to be nested within an understanding of how macro-level Green Revolution narratives and associated technologies are translated and promoted by national policy narratives (as discussed in Chapters 3 and 4) and ultimately adopted, adapted or contested at the local level. Therefore, this chapter builds on the multi-level approach and presents the encounters that take place at the interface between these broader narratives – and the technologies and practices they bring through project interventions – and the micro-

level day-to-day farming practices. The result is a reconfiguration of socio-technical systems at the local level that adapt, reinvent or reject external interventions in new ways, as part of ongoing farm dynamics.

This interface between local farming practices and project implementation is a major focus of the two case studies presented in the next two chapters. Building on this chapter, the following case studies examine how farmers translate their knowledge about a technology into practical use, depending on their individual socio-technical setting and the social and political basis of their interactions with project staff and the knowledge networks they draw upon. The chapters build on the mainstream Green Revolution narratives about production, markets and technology promoted by the dominant policy actors at the global and national levels (presented in Chapters 3 and 4). They show how these narratives confront local realities and how these are transformed, challenged and reinvented.

The following two case studies (MVP and NAAIAP) focus on this social and technical interface and the role that social and organisational structures play in the uptake of the package promoted by these input-support programmes. They demonstrate how localised socio-technical realities heavily affect programme design, implementation and outcomes. The two chapters explore the ways in which local political dynamics, social structures, cultural features and institutions influence smallholder farmers' responses to new technology and how they place value on it. They examine how the technology interacted with the existing local socio-technical system and how people adopted, adapted or contested the technology to fit their own socio-technical realities. These two chapters analyse the ways in which the continued use of a new technology is influenced by factors that are often external to the technology itself. They show how adoption depends on the delivery mechanism used to introduce a technology package to a community. Through this process, they demonstrate how a socio-technical system is constructed over time, through a series of encounters in the field, and how diverse narratives from the macro to micro levels interact and ultimately influence the aims, design and outcomes of programmes.

Chapter 6

Millennium Villages Project:
Evolution of an integrated and intensive development model

The Millennium Villages Project (MVP) is an international development initiative coordinated by The Earth Institute at Columbia University (USA), Millennium Promise (an NGO based in New York) and UNDP. MVP grew out of recommendations stemming from the United Nations Millennium Project – an independent advisory body created in 2002 by the UN Secretary-General, to develop a concrete action plan to achieve the Millennium Development Goals (UN Millennium Project, 2010).

The underlying objective of the MVP is to show that poverty in rural African communities can be overcome by science-based interventions that focus on well-known technologies to combat the multifaceted nature of poverty. The primary goal is to prove that the MDGs can be attained using low-cost, technologically proven interventions in a multitude of sectors, implemented concurrently to benefit from synergies between sectors. By designing a delivery mechanism for community-based integrated programming, within a set financial envelope of US$110 per capita over a period of five years (UN Millennium Project, 2010), the project hoped to use it as a 'proof of concept' model for increasing the levels of aid committed by G8 countries in the Monterrey (2002) and the Gleneagles (2005) Summits.

The US$110/capita/year investment envelope was created by the UN Millennium Project to indicate the total cost required for developing countries to reach the MDGs. This amount is to be cost-shared by donors, government, the community and the private sector, which roughly translates into the following funding sources:

- US$70 raised by donors (MVP to supply US$50 while raising funds from other donors/private sector for remaining US$20),
- US$30 provided by national government,
- US$10 per person from households, either in kind or in labour.

The per capita investment is split along sectoral themes to indicate a general target of investment per area, including agriculture, nutrition, health, infrastructure, education, environment, business development, water and sanitation. The project outlines the investment per sector, but this can change slightly, depending on the location and priorities of the sites. However, each site is expected to dedicate a portion of the budget towards each sector. Teams of technical experts work with community-developed committees to plan and implement a series of interventions that are contextualised for the local situation. Such topics as community development/empowerment and gender issues are integrated within all these sectors.

Design features of the MVP

MVP is a site-intensive programme that operates in 14 different sites in 10 countries across Africa.[54] The sites span most agro-ecological zones and therefore represent almost every type of farming system adopted by smallholders in Africa. Specific sites are selected based on a definition of hunger 'hotspots', where chronic hunger and malnutrition is considered widespread. The sites also have a high prevalence of such diseases as HIV/AIDS, malaria and tuberculosis, as well as a lack of basic services and infrastructure. Government involvement is considered to be an important component and sites are located where national governments are committed to the initiative and to achieving the MDGs (Millennium Villages Project, 2010: 10). Final selection of the locations within countries is done in close collaboration with government to ensure coordination of efforts and partnerships.

Creating a new Millennium Village site requires guaranteed funding of US$1.5 million over five years for a population of roughly 5,000 people. This is to guarantee that each site has sufficient funding for a range of activities over the five-year period. MVP coordinates most of the development activities in these areas, including those of other development organisations and government departments (except for the basic services of health and education). There are finite geographical boundaries and activities do not go beyond these.

[54] The countries are Ethiopia, Ghana, Kenya, Malawi, Mali, Nigeria, Rwanda, Senegal, Tanzania and Uganda. For more information see: http://www.unmillenniumproject.org/mv/index.htm.

There are three different types of MVP site.[55] The first category is 'research villages' (MV1), which have a research component added to their agendas. These sites are managed by the Earth Institute and have an additional US$50 per capita in the budget for research-based activities. This extra cost is to cover the expenses of expert staff at Columbia University, the Africa-based MDG Centres or other partners that offer technical advice to the MV1 research villages. The cost for the management of the project in New York is covered under a separate budget and is estimated at US$250,000 per annum per project site. There are 12 MV1 sites. MV1s have more extensive baseline data collection as well as monitoring and evaluation strategies for each household. There is a high level of external staff interaction and the results of the MV1s are expected to be used as models for future village sites (e.g., MV2s, explained below). Sauri Sub-location in Siaya District was the first MV1, established in 2004, and is one of the study sites of this research.

The second category of MVP sites is 'cluster sites' (MV2). Each cluster site contains approximately 5,000 people and these are typically adjacent to an MV1. Millennium Promise manages MV2s. These sites do not have the intensive research components characteristic of the MV1s, although all other intervention activities are similar. The project states that these cluster sites benefit from 'economies of scale' and draw lessons from the neighbouring MV1 research village. Baseline data is still taken in the MV2s, although at a representative sample level (rather than the individual household level, as in MV1s). Two of the sub-locations in this research, Nyandiwa and Lihanda, are MV2s, and these are located adjacent to Sauri MV1.

The third, and most recent category is MV3 sites, which are created and funded independently by other organisations. MV3 sites follow the same model as the others but are not under the guidance or control of the Earth Institute or Millennium Promise. This research does not examine MV3 sites since their designs are independent of the MVP and their input-support programmes vary considerably from those in MV1 and MV2.

[55] The descriptions of MVP sites are based on data collected from series of interviews with MVP staff in Nairobi and Kisumu between April 2009 and August 2009.

MVP is an integrated programme that delivers multiple interventions in agriculture, health, environment, infrastructure and education to the same recipients at the same time. This integrated approach remains a key component of the MVP strategy and philosophy. The storyline behind MVP's holistic approach states that many of the problems in rural areas (including health, food security and poverty) are caused by failures in multiple sectors and require various entry points to address them (Millennium Villages Project, 2010). In addition, by implementing interventions in an integrated fashion, the project hopes to benefit from the synergies that occur through multi-sectoral interactions. For example, addressing health issues will not only improve the health of the community, it will also have a lasting effect on agricultural productivity by reducing lost labour due to illness, or allowing money to be redirected towards purchase of improved inputs instead of towards health care.

MVP has received a lot of attention from development practitioners, the media, governments, donors, and the public at large.[56] This is due in part to its vast network of promoters from a variety of sectors and a very well organised campaign to keep the villages in the spotlight. This stretches from the high politics of MDGs and high-profile actors involved in the negotiations to the perceived high budget allocations and subsidised delivery systems. The project also represents a return to a model of integrated development, which has critics and supporters that debate the merits of the project's principles of integrated development within a high cost set of interventions. Issues of sustainability and the ability to take the model to a large scale continue to be discussed and debated in development circles. MVP has evolved over time in response to these multiple interactions, which combine high-level policy decisions with field-level realities in a complex mix.

A number of evaluations, both internal and external, have examined MVP (cf. Cabral et al., 2006; Buse et al., 2008; Denning et al., 2009; Dorward, 2009; Nziguheba et al., 2010; Okoth, 2010). This research does not aim to replicate these evaluations, but

[56] See recent blogs and debates on Millennium Villages in the Lancet (http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)60824-1/fulltext), the World Bank (http://blogs.worldbank.org/impactevaluations/jeff-sachs-the-millennium-villages-project-and-misconceptions-about-impact-evaluation), the Guardian (http://www.guardian.co.uk/global-development/poverty-matters/2011/oct/10/millennium-villages-project-impact-questions) and Development Horizons (http://www.developmenthorizons.com/2011/10/jeff-sachs-lvp-of-mvp.html?spref=tw).

instead adds to them by presenting a wider analysis of the MVP as a uniquely constructed socio-technical system that has specific narratives about achieving the MDGs through a set package of technical interventions. This research looks at reasons why the households interacting with the MVP technology packages may adopt, adapt or reject the technologies, due to overarching market-related factors, patterns of supply and demand, social interactions, and the institutional and administrative structures of the programme. The next section examines these intersections at the household level and explores the ways in which the MVP narratives, administration and interactions with households' unique farming contexts ultimately affect the style and consequences of delivery.

Unpacking the socio-technical system: Interactions between farmers and MVP in Siaya District

This section examines how the programme was introduced to the community and the entry points used to build awareness of the programme, its goals and the technology package offered. It then analyses how the distribution channels used in the programme interacted with the farmers and the range of perceptions this created. It describes how the programme was able to use the existing administrative structures in the community to reach some of its goals. The programme's ability to disseminate information about the technology to ensure appropriate understanding and acceptance of the package of inputs is also highlighted. The section concludes by looking at the viability and sustainability of the institutions that were altered or created by the programme.

The politics of community mobilisation and sensitisation: Siaya District MVP

In July 2004, Sauri Sub-location, in Siaya District of Western Kenya, was selected to be the first Millennium Research Village, based on a number of factors (UN Millennium Project, 2005: 2):

(i) Located within a 'hunger hot-spot' defined by the UN Millennium Project's Task Force on Hunger as a location where more than 20 percent of children under five years are underweight for their age group

(ii) Represents one of the 12 key agro-ecological zones in Africa –Siaya represents a 'bimodal maize-growing region';

(iii) Resides in a country where the national government was committed to furthering the MVPs and would partner with the project in its activities;

(iv) Offers possibilities for collaboration with NGOs operating in the area.

This area also had a long history of donor-led agriculture programmes. For example, the World Agroforestry Centre (formerly known as the International Centre for Research in Agroforestry or ICRAF) had been conducting agroforestry projects in the surrounding area over the previous 10 years and had a long-standing history with the MVP founders.[57] This facilitated MVP's entry into the villages. In fact, many farmers in the community had previous contact with MVP staff members who used to work with the World Agroforestry Centre. As Jessica Masir, the MVP Community Coordinator explains:

> *I would not say that the project was new in Sauri, because most of the Millennium staff that the Sauri community met were staff who had worked in Sauri before with other ICRAF-related programmes. Therefore, they knew each other.*[58]

This close connection between MVP staff and the community helped to facilitate one of the main narratives that underpin the programme: that of an integrated, community-based approach to achieving the MDGs. When MVP began in Sauri, project staff spent a considerable amount of time making sure certain community structures were in place before starting on the technical interventions. They did this by creating three types of institutions. The first is what MVP calls 'multi-purpose steering institutions', which occur at multiple levels, from the village to the district. The second are 'sector group institutions', which are single-purpose committees, such as the Health Management Committee, Agriculture Committee, Water Management Committee and Forest Committees. The third are 'executive leadership institutions' at the village and higher sub-district level. For example, MVP created Executive Committees that are leadership positions within the communities and represent the official channels between the village and the programme staff.

[57] Interview, Pedro Sanchez, Director, Tropical Agriculture and Rural Environment Program, Columbia University, March 1st, 2011.
[58] Interview, Jessica Masira, MVP Community Coordinator, Kisumu. May 7th, 2010.

Since these structures did not exist in Sauri, the MVP started with an initial two-week training on community action planning with the leaders of the newly formed village committees. At the same time, they worked with the community to create eight sectoral committees (for water, environment, health, education, etc.) at the sub-location level and parallel committees at the village level. These committees were organised to address one of the eight MDGs. The sector committees were asked to meet once a week to discuss plans and activities within their sector. The heads of each village-level sector committee would then come together at a larger sub-location sector committee to coordinate the sectoral activities for the greater sub-location. The sectoral committees would work with MVP staff to carry out each of the sector activities. MVP used the same methods and structures to expand to the surrounding 10 sub-locations in 2006.

However, MVP staff were careful to consider the existing local institutions. Where there was an existing structure, such as a village development committee, then MVP tried to work within that arrangement. However, in places where MVP staff felt that the structure was either nonexistent or not operating well, it created or strengthened those institutions. Sauri represented a mix of both systems, as explained by Rafaela Kozar, MVP's Community Development Coordinator:

> *When MVP came in, the pre-existing structure in Sauri was called a 'Sub-location Development Committee' and the one in Sauri in particular was fraught with conflict with a particular leader there at the time, and had not held a meeting in years. There was not an immediate clear entry point and we would not be able to revitalise the existing structure in a timely manner for the project to start intervention.*[59]

Therefore, the community and MVP deemed the original development committee ineffective and the project worked with the community to create a new development committee and consultative forum as a short-term solution. According to Jessica Masira, this model worked well for the site. The most important component when incorporating community participation was to appreciate pre-existing structures within the community and then build on them through participatory approaches:

[59] Interview, Rafaela Kozar, MVP/EI Community Development Coordinator, Nairobi, June 24, 2010.

> *We worked on mainly improving the structures to do with administrating the interventions. We were working on management structures by the community and just agitating, awakening the government officials to participate actively in the whole thing. The agriculture sector had started to deliver the inputs and so we had to build on what had already been created. Therefore, we continued to refine the existing structures in the village.*[60]

To help facilitate the MVP's specific input-support programmes, Agriculture Committees were set up at each village and sub-location level. Each village elects an Agriculture Representative and these representatives come together at the sub-location level to form the Agriculture Committee. At the initial stages of the project, the Agriculture Representatives were tasked to work alongside MVP staff to measure farmers' plots and determine the amount of seeds and fertiliser the farmers would receive in the input-support package. They would also assist with regular monitoring of farm activities.

MVP depends heavily on the committees to disseminate information. For example, the village-level Agriculture Committee performs a variety of tasks, such as information dissemination, monitoring the implementation of an intervention and collecting yield data. All members of the Agriculture Committee receive training under a 'training of trainers' (TOT) model. After receiving training, committee members go on to train other farmers about the techniques they learned from MVP. An Agriculture Representative for Lihanda explains:

> *If there is information that the project wants passed on to the farmers, then they can come to us, and we go door-to-door or hold a Chief's Baraza [public meeting] to pass on this information.*[61]

While the MVP invested a lot of energy into building committees, the results were often mixed. Many of the results hinged on individual characters and the power relations within that village. Therefore, the extent to which MVP could rely on these committees to carry out the work varied considerably. For example:

> *In Sauri, there has been a very strong Agriculture Committee and there, master farmers took ownership and leadership of the many activities. Whereas in other*

[60] Interview, Jessica Masira, MVP Community Coordinator, Kisumu, May 7, 2010
[61] Interview, Agriculture Representative, Focus Group Discussion, Lihanda, Siaya, April 22, 2009

sites, the committees might be much weaker and then actually the agriculture staff of the project might end up doing most of those activities.[62]

The key to a committee's success is its ability to disseminate information and be inclusive. Therefore, to facilitate information dissemination, MVP selects a number of farmers in the community who have extensive knowledge, who are leaders in the community, or who are considered 'master farmers' (those considered by the project as highly productive or who had been involved in previous ICRAF interventions). MVP also looks for younger farmers who might be interested in agriculture interventions and starts them out as aides to the facilitators, extension officers or master farmers who took up larger roles. These village facilitators act as resource persons in the community to help facilitate the MVP programmes.

Figure 14: Eunice Owino showing her maize fields and the spacing technique she learned, Siaya, May 2009

When MVP disseminates information to the community, it convenes village-wide training sessions during the planting season. MVP sets up two or three group training sessions in a given area and every community member is obliged to attend if they wished to receive the agricultural input package. If a farmer does not attend the training then they do not receive the package. A team consisting of MVP's agriculture extension agents, the elected Agricultural Representatives and the master farmers follow-up on the training. The team visits each farm, offering technical advice and monitoring progress. MVP relies on this network of staff and community participation to communicate technical information.

[62] Interview, Rafaela Kozar, MVP/EI Community Development Coordinator, Nairobi, June 24, 2010

However, the vast amount of information that the project attempts to disseminate can lead to misinformation and conflicting messages passing on to the community. At times, farmers refer to the lack of information and to feeling that some individuals in positions of power are hoarding the information for their own personal gain. The next section describes these social conflicts centred on those elected onto the committees. It describes some of the social tensions that arise as a result of creating committees and community institutions.

Social and power relations

The MVP's philosophy is based on a particular framing of community-led and participatory decision-making approaches. The concepts of participatory development have evolved since the 1980s (Chambers, 1980; Korten, 1980; Longhurst, 1981; Korten and Klauss, 1984; Cernea, 1985; Richards, 1985; Chambers et al., 1989; Chambers, 1994, 1997) and include a suite of participatory approaches and methods that emphasise local knowledge and enable local people to make their own appraisals and plans. This has allowed development practitioners, governments and local people to work together to plan context-appropriate programmes. Although participatory approaches are aimed at inclusion, this approach has also been subject to criticism for not addressing issues of information and knowledge sharing at the community level (Kapoor, 2002), especially in relation to biases against women (Mosse, 1994; Guijt and Shah, 1998), and concerns that it can ultimately favour the existing elites (Mosse, 1994; Kapoor, 2002).

Therefore, Cooke and Kothari (2001), contend that community and participatory approaches have the potential to become 'tyrannical' and thereby to oppress those they seek to empower. They argue that participatory projects that attempt to generate empowerment, but do not take into account local politics and power relations, can result in another form of technocratic imposition (Cooke and Kothari, 2001). Development practitioners cannot be naive about the complexities of these power structures within communities and must understand that "technology is mediated by social processes, and the social relationships into which they are introduced" (Place et al., 2003: 4). This research aims to highlight how local social networks and power

relations interact with the technologies promoted by MVP and how knowledge-power-politics relationships contribute to the development outcomes of the project.

Part of MVP's overarching narrative revolves around the need to combine technical expertise with community-based learning and knowledge to ensure science-based development. This commitment to a bottom-up approach is one of the principles by which the project separates itself from past failures with the integrated rural development programmes of the 1970s.[63] Village-level committees and community members work with groups of technical experts during the initial stages of the project to identify possible interventions. These interventions are ranked according to community preferences and against the MVP's pre-set menu of interventions. Together, the community and experts create a package of village-level interventions and a community action plan (Konecky and Palm, 2008; Millennium Villages, 2010; UN Millennium Project, 2010). The ideal narrative is one whereby the local socio-technical system is co-developed by communities and experts, allowing innovative niches to evolve and reinforcing or readjusting the learning process.

However, this ideal does not address unequal power relations in the process. Participation challenges arose during the early days of the project in Sauri. Initial challenges included high expectations among community members of the benefits of becoming involved with a high-profile donor project. As Rafaela Kozar states:

> *In Sauri there were quite a number of challenges in the beginning, a lot of common challenges you find in community development. Definitely, people who signed up for these committees were expecting some kind of individual benefit from being in the committee.*[64]

Another common problem centred on exactly which people were participating in the committees and attending the meetings. Ensuring equal representation from every member of society is a constant problem encountered by MVP, especially when it first started working in Sauri. Willy Diru, MVP's Agriculture Coordinator, describes this challenge in detail:

[63] Various interviews with MVP project staff.
[64] Ibid.

> *You have a process that is targeting the entire community but you never get to that level because the elites are always there and blocking that contact. When you look at the vulnerable they will not come to meetings and they may have good reason for not coming. They might come to meetings but eventually they are cut out in one way or another. So how do I get to this particular disadvantaged group so that they are not cut off? These people who remain vulnerable, there are certain things that keep them in that wealth category. It requires a specific examination of those things to come up with ways to address them. Sometimes you will find the vulnerable are not coming to meetings simply because of the way they dress. The community have their own social categories based on who is well dressed at a meeting and when the vulnerable come, they look out of place. Therefore, that social stigma will keep them away from attending those meetings.*[65]

This form of social ostracism creates a process of social differentiation and influences the power relations in the village. The poor become even more isolated because they cannot participate in the project meetings. Therefore, the project becomes reliant on local patronage relations with elites, who gain even more access to the material benefits of the project. This restructuring of social and political relations is at the core of the evolution of the MVP socio-technical system.

However, some MVP staff members note how this system is changing and that the programme's approach to community involvement has evolved:

> *I do think there has been an evolution in the approach. In the beginning in Sauri the people that came forward were either natural leaders or had an advantage in that they were elite in some way and they were able to benefit more than others. However, I certainly would not say that was 100 percent of the people involved in the project now.*[66]

By 2010, the project was in its sixth year and MVP staff members had been able to reach further to some of the vulnerable groups. A few staff felt that they were better equipped to focus on excluded people who may not have come forward at the beginning of the project. However, with such a large geographical area, an increasing number of recipients, and mounting strains on staff time to deliver all the components of the project, it is still to be determined whether all households had similar interactions and opportunities. This point is discussed in detail in the last part of this chapter.

[65] Interview, Willy Diru, MVP Agriculture Coordinator, Kisumu, May 7, 2010
[66] Interview, Rafaela Kozar, MVP/EI Community Development Coordinator, Nairobi, June 24, 2010

Another challenge relates to the fact that MVP relies heavily on volunteer positions from the communities to manage the committees. There are heavy time commitments attached to these positions. Therefore, this time-related cost to participation affects community members differently depending on their ability to dedicate time. From the group of farmers interviewed in this research, 22 percent had been involved in one of MVP's committees. Of these farmers, membership is evenly divided between the two highest wealth categories. One poor farmer from the lowest wealth category explains:

> *I already suffered from labour shortages on my farm and these commitments to participate in committees and planning groups were an even greater burden. They have so many meetings and I do not have the time to go there to listen.*[67]

Therefore, volunteering in certain committees excludes farming households who find it difficult to participate due to labour/time commitments or other social pressures. These constraints to participation fundamentally influence the social and power relations within the socio-technical system. The emphasis on participation, within a non-homogeneous community, creates an unhealthy dynamic in which certain wealthier groups within the community are able to benefit disproportionately.

In addition, due to the numerous development activities occurring simultaneously within the community, there is a large investment and related costs for MVP staff to ensure knowledge transfer and community involvement and participation. MVP staff members mentioned the personal and financial costs of organising the community to attend regular meetings for all the committees. Dependence on community participation caused frictions at times due to the fast pace of the MVP planning process and the need to synchronise implementation schedules. Some activities could not be carried out as planned because the government or village contributions were not in line with MVP planning deadlines. Moreover, delays in community contribution (i.e., community labour for various activities) affected some MVP activities.

According to one Siaya focus group meeting, over the course of six years this became a growing problem with community members asked to participate in too many MVP committees. This resulted in falling participation rates and MVP village meetings

[67] Interview, female farmer, wealth category B, Nyandiwa, Butere, July 23, 2009

becoming less well attended.[68] This mounting apathy challenges the 'participatory' model that MVP espouses. According to one MVP staff member, low turnout in community feedback meetings has become a constant problem:

> *The problem is that farmers are busy planting and MVP needs to plan meetings around the calendar of farmers. The problem is that there are so many sectors and each sector has their own meetings and own committees and these require a lot of the community's time.*[69]

The project relies on committee meetings to pass along information on MVP-related activities to the specific sector committees. However, it has proved difficult to ensure community attendance and that the right information is transferred to the broader community. Social structures again come into play in the dissemination process. At times, information from MVP stayed mostly within the committee and its members, failing to reach community members not involved in the committee, or not within the social networks of committee members. A number of farmers described how community members shared information within their own social networks, leaving out other groups (i.e., lower social standings and wealth categories):

> *The elected leaders ignore us in information delivery. Sometimes the information from MVP does not reach us out here.*[70]

An elderly male farmer from the lowest wealth category who lives in a remote part of the sub-location expressed his concerns:

> *I feel that MVP ignores this area at times, especially when it comes to information dissemination. Nothing about MVP is communicated to us.*[71]

This section illustrates that participatory development does not automatically translate into a process in which the participation of people within the development activities is realised. The knowledge included or excluded is subject to the local power networks and social structures that define the knowledge at that moment in time and space (Foucault, 1989). Therefore, knowledge becomes a 'social product' (Antweiler, 1998)

[68] Sauri focus group meeting, Siaya, April 2009.
[69] MVP staff meeting, Yala Town, Siaya, April 2009.
[70] Interview, male farmer, Wealth Category B, Nyandiwa, Siaya, September 10, 2009.
[71] Interview, male farmer, Wealth Category C, Nyandiwa, Siaya, September 9, 2009.

and it is not shared equally and thus "not necessarily sustainable, or socially just" (Bicker et al., 2004: 10). According to Cornwall (2002: 56):

> *Without a dynamic understanding of people's social networks and the institutions and dimensions of difference that matters in the pursuit of their livelihoods, naive efforts to bring about equitable change may simply make things worse.*

MVP encountered exactly these challenges with the participation model as it aimed to implement a bottom-up approach to community and participatory development. The next section looks deeper into the capacity building and participation components of the model.

Capacity building and participation

An important part of MVP's programme involves training farmers on techniques of planting and soil health management, including application of fertiliser. Many of the respondents (61 percent) mentioned that they were using no fertiliser prior to MVP. Low use of inorganic fertiliser was confirmed by baseline data, which indicated that fertiliser use averaged only 1.5 kilograms of nitrogen and 1.1 kilograms of phosphate per hectare, resulting in poor crop production (average 0.9 tonnes of maize per hectare) (Millennium Villages Project, 2007: 12).

The baseline study found that farmers used a combination of soil management techniques, including small amounts of inorganic fertiliser (DAP, urea), *boma* (farmyard) manure, compost, green manure (i.e., from trees and shrubs such as *Tithonia diversifolia*) and other techniques introduced earlier by ICRAF. However, the main goal for MVP was to increase productivity and their input package was based on hybrid seed and inorganic fertiliser. Therefore, the project spent considerable time training the farmers on fertiliser application, seed placement, spacing and weeding techniques. The aim was to transform the socio-technical system from a low- to a high-input system.

Out of the 36 MVP households interviewed, every individual was able to describe in detail the training they received during the first two years of the programme. This high number is not surprising, since training sessions were a prerequisite to receiving the

input package. Some of the training was centred on improving or changing current planting practices. Some farmers mentioned that, prior to MVP, they were broadcasting maize seed and that one of the biggest lessons they learned was to plant in a row:

> *I learned to use a spoonful of fertiliser and maize spacing was to be two feet. Before MVP we were broadcasting both maize and beans. At first we were told to plant maize in a pure stand but the second year we were told if we want to intercrop then we have to plant even beans in a line. We are still using that technique.*[72]

One female farmer from Nyandiwa described a new planting technique that she learned and that changed the way she plants her crop:

> *We were trained since MVP came the first year. The kind of training given has helped. The main knowledge I got was on use of fertiliser. I also received knowledge on how to plant in lines. That is the knowledge we are still using today.*[73]

Almost every farmer interviewed described the training as one of the main benefits they received from MVP. However, interest in attending meetings and training has waned over the past few years. Only 14 percent of respondents confirmed attending an MVP meeting in 2009/10. The rest acknowledged it had been a while since they attended a meeting mostly because they had received no communication from MVP:

> *The Millennium used to come when they gave some fertiliser and seed but after last two years, nobody has come. Most times, we have even forgotten that Millennium is around. We only remember when we see the red plated vehicles drive through our village.*[74]

This decrease in participation in meetings and training also affected membership in some of the sectoral committees set up at the beginning of the project. As one well-off male farmer from Sauri explains:

> *I used to be on the Education Committee. I am still a member but it has slackened over the years. There is no burning interest like when we first started.*[75]

[72] Interview, male farmer, wealth category A, Nyandiwa, Siaya, May 3, 2010.
[73] Interview, female farmer, wealth category A, Nyandiwa, Siaya, April 29, 2010.
[74] Interview, male farmer, wealth category B, Sauri, Siaya, April 27, 2010.
[75] Interview, male farmer, wealth category A, Sauri, Siaya, May 4, 2010.

MVP's Agriculture Coordinator Willy Diru has heard that villagers feel they no longer hear from the project because "it is winding down." In his view, participation at the training was very high during the initial phase, but they have had difficulty in getting farmers to participate in activities and meetings more recently, after the subsidies were phased out:

> *What was driving the farmers to come to the meetings was because they would be told the processes of getting free inputs. So now, you go to the meeting and you are told that these inputs are not going to be free and we are going to link you now with service providers, like the agro-vets and financial services. Then the person goes through his mind and says, "Maybe this is not the sort of thing that I am going to come here for", so they drop out because of that.*[76]

This puts into question the value farmers placed on the training, when the main benefit of attending the training was perceived as the receipt of subsidised inputs. While many farmers have changed their farming practices to incorporate the lessons learned, it remains to be seen how long the new techniques will continue, especially when the training was not the initial reason for attending. One farmer highlights the link between participation and receiving inputs and explains why she no longer attends meetings:

> *I will only go to these trainings if I get fertiliser. When Millennium came, they started very strong, they brought us fertiliser and seeds. However, those of us who started weak are still down. Therefore, I feel that Millennium is just looking at those who started strong. Those who were weak they did not follow.*[77]

Participation in the training was not based on farmers' inherent need to learn about a new technology but was linked to being rewarded with a substantial package of valuable commodities. The result of linking training with inputs creates the situation in which participation begins to wane when the inputs are no longer there. Therefore, these external reward structures shaped the socio-technical system, which has a direct effect on the main outcomes of the programme. The following section goes into detail on the evolution of the input-support package and the outcomes of the programme.

[76] Interview, Willy Diru, MVP Agriculture Coordinator Interview, Kisumu. May 7, 2010.
[77] Interview, female farmer, wealth category C, Lihanda, Siaya, April 27, 2010.

MVP's input-support programme: From universal subsidy to targeting

One of MVP's main interventions is the supply of subsidised fertilisers and improved seeds to every household in the Millennium Villages. The underlying strategy was to "quickly and dramatically increase crop yields" by applying inorganic fertilisers "at recommended rates, ranging from 50 to 100 kilograms of nitrogen and 5 to 20 kilograms of phosphorus per hectare" (Millennium Villages Project, 2010: 21) .

In 2005, the first year of MVP, every farmer in Sauri received the equivalent of 100 kilograms of nitrogen and 50 kilograms of phosphorus per hectare on all plots planted with maize for the long rains (Millennium Villages Project, 2005: 8). This translated into two bags (100 kilograms) of DAP planting fertiliser, 1 bag (50 kilograms) of urea top dressing fertiliser and 10 kilograms of maize seed for each acre (0.4 hectares). MVP, the Agriculture Committee and the landowner calculated the land area for each household and determined the size of the input package. The smallest quantity of DAP received among Sauri respondents in this research in the first year of subsidy was 50 kilograms and the largest was 300 kilograms. Willy Diru, MVP Agriculture Coordinator, explained the process:

> *In the first year, Sauri got a high level of subsidy. The amount of subsidy was much higher than in the other sub-locations. In Sauri, one could get as high as 150 kilograms of DAP because every farmer was provided according to the area of land that was measured. The maize plot area determined the amount of fertiliser a farmer would receive.*[78]

The MVP agriculture team, which included soil scientists and other experts based in New York and Kisumu, designed the input package. They conducted baseline soil surveys in Sauri and found the soils to be deficient in nitrogen and phosphorus (Chomba, 2007: 60). Due to the severity of nitrogen depletion, the MVP team decided to provide a technology package that supplied a heavy dose of nitrogen fertiliser (100 kilograms per hectare) in the first year. According to Patrick Mutuo, there was little fear of acidifying the soil with this high level:

[78] Interview, Willy Diru, MVP Agriculture Coordinator, Kisumu. October 16, 2009.

> *We were dealing with highly buffered soils. Therefore, we would need something like 20 years of application of urea to make an impact on the pH levels of the soils.*[79]

Application of 100 kilograms of nitrogen per hectare is above the KARI recommendations of 75 kilograms per hectare (KARI, 1994). KARI's recommendation was based on the Fertiliser Use Recommendation Project (FURP), a national field testing trial conducted between 1966 and 1986 (FURP/KARI, 1994). Kenya's current national fertiliser recommendations stem from these early trials. The MVP agriculture team felt that the FURP/KARI trials were outdated for this area and, based on the optimal rates of return from MVP field tests, decided to use a heavier dosage.

Despite existing criticisms from others (cf. Gudu et al., 2005) that the KARI recommendations are already too high, particularly for the majority of smallholder farmers in Western Kenya who cannot afford them, MVP was concerned initially with getting the highest yields possible for the farmers. Due to the high profile of the project and the desire to meet the MDG goal of 'halving hunger' within five years, there was a strong interest from project designers to obtain fast and impressive results. Therefore, MVP's initial distribution of fertilisers was aimed at improving yields and demonstrating results quickly. As Diru explained:

> *The initial philosophy was this issue of 'quick wins'. You go in there and have an impact, a bang, in addressing the issues of hunger by raising food availability through increased yields. To me it was the right thinking because it had the right impact, where within the first year the households were seeing themselves with vast quantities of maize. We even had problems with storage within the homes. It had a very big positive impact and prepared the entry of the other agricultural interventions, such as diversification, later on.*[80]

This initial package design was applied only for the first year. In the second year of the project (2006), MVP widened its operations, increasing the number of households from the original 1,000 to roughly 11,000 households. They also changed the input package, setting quantities of inputs at a predetermined rate that was no longer based on acreage.

[79] Interview, Patrick Mutuo, Agriculture Specialist, MDG Centre, interview, Nairobi, April 11, 2011.
[80] Interview, Willy Diru, MVP Agriculture Coordinator Interview, Kisumu. May 7, 2010.

For Sauri, the second-year package of inputs was 50 percent less than that received in 2005. MVP determined that farmers within Sauri (MV1) were to receive 50 kilograms of DAP and 50 kilograms of urea per 0.4 hectare. The interviews support this, with all the Sauri farmers describing how they received half the package in the second year. However, they were still receiving inputs for multiple maize plots. For example, two farmers from Sauri received 150 kilograms of DAP in the second year. Therefore, the second-year inputs were still enough for most farmers' main plots and yields continued to increase.

The surrounding 10 sub-locations (MV2) were treated differently. MVP staff decided to base the subsidy input package on an estimation of land sizes. MVP conducted a household land survey based on 300 randomly selected households from the 10 new sub-locations, from which they calculated the average holding size to be 0.34 hectares per household. Diru explained this breakdown:

> *In the other villages, we estimated an average acreage for the whole cluster that was 0.34 of a hectare. Therefore, each household received an equivalent of 40 kilograms of fertiliser, which is sufficient for 0.34 hectare. Instead of varying inputs we assumed each farmer gets 40 kilograms of DAP and 40 kilograms of top dressing. Everyone got the same amount in these clusters, whereas in Sauri each farmer was given inputs according to their farm size.*[81]

There were several reasons for giving a uniform rate. First, the expansion of the programme meant it was no longer feasible for project staff to measure each plot of land. Second, each new sub-location was labelled as MV2, which meant they were not considered 'Research Villages' (MV1) as in Sauri, and received a lower level of monitoring and reporting. Third, and most importantly, the MVP operates within a set budget for the inputs, which was based on a predetermined value of 15 percent of the overall budget, based on a ratio of 1,000 farming households per sub-location. The new sub-locations had more households than anticipated, so MVP field staff decided to limit the amount of the input packages to fit within the existing budget constraints.

[81] Interview, Willy Diru, MVP Agriculture Coordinator, Interview, Kisumu. October 16, 2009.

MVP field staff members explain the change in policy from universal to targeted subsidy and the programmatic choices that happened due to budget constraints. Patrick Mutuo, who used to coordinate the Sauri site, clarifies the rationale:

> *Yes, five years is what was promised to the communities when we started the project. However, the reason for limiting the subsidies was based on the whole MVP budget. The cost of fertiliser would have taken the whole agriculture budget and if it went on for five years then it would have over shot the entire budget, leaving very little for other activities.*[82]

At this stage, the MVP input-support programme began to adapt to the overarching administrative pressure from the subsidy requirements and its financial limits. MVP cluster administration staff were given some leeway to interpret the model according to the specific conditions on the ground, and therefore the overall input programme in Siaya began to change as field and budget realities evolved over time.

Introduction of a micro-credit scheme

By the third year of operations (2007), both MV1 (Sauri) and MV2 (including Nyandiwa and Lihanda) were receiving a greatly reduced subsidy. The project had hoped that after two years of declining subsidy that the farmers would make up the difference and 'top-up' with the amount of fertiliser needed to continue their levels of productivity. Diru described the process:

> *The first year was full subsidy and then the second year it was reduced. In some places, it was reduced to around 75 percent, in other places to 50 percent. We were asking the farmers to make up the balance. There was an assumption that you provide that 50 percent and then the farmer will go out to the shops and buy the difference to make up to what he needs.*[83]

The assumption that farmers would 'top-up' with additional fertiliser was met with mixed results. In the MV2 cluster sites, farmers received 75 percent of the previous year's inputs which meant those who had received 30–40 kilograms of DAP in 2006 received 25–35 kilograms in 2007. Farmers' reactions were varied. Approximately 28 percent described how they managed to purchase additional fertilisers, ranging from 10

[82] Interview, Patrick Mutuo, Agriculture Specialist, MDG Centre, interview, Nairobi, April 11, 2011.
[83] Interview, Willy Diru, MVP Agriculture Coordinator Interview, Kisumu. May 7th, 2010.

to 35 kilograms. The majority of the households that were able to purchase additional inputs came from the highest wealth category and were overwhelmingly male-headed households. The rest of the interviewed farmers adjusted to the reduction in subsidy by incorporating their existing methods of soil fertility management. They mixed the fertiliser with farm manure or compost to make up for the decrease in quantity. A small number of households interviewed, mostly from the lowest wealth category, did not top up at all. This group described how they changed the application rate, applying '*mos mos'* (little by little) on the plots closest to their homes.

In 2007, MVP also piloted a credit voucher system in Sauri in partnership with Saga Thrift and Enterprise Promotion Ltd (Saga), a local micro-finance institution (MFI). The input subsidy ended for approximately 75 percent of farmers in Sauri, and they were asked to register with Saga to receive a loan for the inputs instead. The remaining 25 percent of Sauri farmers were listed as 'vulnerable' and were targeted for a special input subsidy programme.

At first, the loans were available only to Sauri farmers. The surrounding 10 sub-locations (which started a year later) still received subsidised inputs through a subsidy voucher programme. This new voucher programme was created by MVP to improve the capacity of agro-input dealers in the area. MVP worked with CNFA (formerly known as the Citizen's Network for Foreign Affairs) Agricultural Market Development Trust (AGMARK), an American NGO that specialises in capacity building, to train and certify approximately 13 agro-dealers in the 11 sub-locations to administer the voucher programme.[84] Vouchers were given to all farmers receiving the input subsidies. The farmers would present these vouchers to the registered agro-dealers to be redeemed for a specified amount of inputs. The agro-dealers were either existing shops that received additional training or new shops set up to improve access to inputs in the area.

A farmer in the lowest wealth category from Lihanda explained how he coped with the decrease in subsidised inputs:

[84] CNFA is working with AGRA to promote agro-dealers in multiple countries. Building agro-dealers to bring technology closer to the smallholder farmers remains central to the efforts of many organisations' Green Revolution agenda. To read more on the links between agro-dealers and the Green Revolution in Kenya see Odame and Muange (2010) "Can Agro-dealers Deliver the Green Revolution in Kenya?" at http://www.future-agricultures.org/science-technology-and-innovation/7612-the-politics-of-seed-in-africas-green-revolution-new-ids-bulletin.

> *The first year with Millennium, I got 14 bags, which is the best yield of my life. I was able to sell three bags to pay school fees and we consumed the rest. However, the second year [2007], the fertiliser was less so I bought some more inputs because I believed if I added more fertiliser my production would increase. However, my production was not as much as I had expected. This year I only got nine bags. I blame the fertiliser we were given by Millennium and too much rain at harvest time. The fertiliser this year looked different and did not perform as it should. However, I am happy I was able to sell four bags to pay for my daughter to learn tailoring.*[85]

MVP's agro-dealer programme suffered from a number of difficulties. First, there was little trust established between the farmers and the new agro-dealer shops. The majority of farmers had not previously purchased inputs through local agro-dealers. Those who did purchase inputs tended to rely on the larger trading centres. Some farmers felt that the agro-dealers were giving sub-standard inputs. Other farmers felt that the agro-dealers were cheating them somehow on the quantity of inputs offered. Samson, an Agriculture Representative from Nyandiwa, explained at a focus group meeting some of the distrust that occurred between farmers and the agro-dealers:

> *In 2007, MVP used agro-dealers and brought in AGMARK, which really sidelined us in the Agriculture Committees. Instead of giving us DAP fertiliser, the dealers brought in another type of fertiliser. Our yields were lower and it went down because the agro-dealers were not giving us the best fertilisers and seed. They gave us bad quality inputs and our yields suffered for it.*[86]

Second, some of the agro-dealers were new businesses, or new to agro-inputs, and lacked proper experience in managing a seasonal business. Many of them struggled to stay open despite receiving training and certification from CNFA/AGMARK. They faced several challenges, including management issues, adapting to the seasonal nature of the products, competition from bigger shops in larger market centres, poor transport links that increased the cost of the inputs, and lack of credit to stock their shelves with adequate quantities of inputs.

Unfortunately, in 2007, farmers in MVP suffered one of their lowest yields since the start of the programme in 2005, even though rainfall was plentiful. This could have

[85] Interview, male farmer, wealth category C, Lihanda, Siaya, May 4, 2009.
[86] Interview, Agriculture Representative, Rawalo C, Nyandiwa focus group, Siaya, April 24, 2009.

been due to the heavy hailstorms and floods that struck the area that year. However, MVP had its own speculation as to the causes of the low yields, according to a report by Nziguheba et al. (2010: 92):

> *In Sauri, the variations in maize yields in 2005 (Year 1), 2006, and 2008 are correlated with seasonal rainfall totals. But the lowest yields observed in 2007, the year with the highest seasonal rainfall, are perhaps due to a shift in the management of inputs distributed from MVP to a local NGO [Saga] and agro dealers.*

This poor performance signalled to MVP that they needed to change the way they distributed their inputs. The poor experience with setting up agro-dealers and using a small micro-finance institute with limited capacity to carry out the voucher programme prompted MVP to change again its course of action. By late 2007, MVP had created a new entity called Millennium Farms Limited to administer a new credit scheme to the farmers in all 11 clusters.

Millennium Farms Limited

Millennium Farms was an agri-business development company created to facilitate the provision of farm input credit to farmers in the MVP and promote contract farming in maize production. It focused on providing credit to the 12,700 maize farmers within the MVP project catchment. Millennium Farms still partnered with Saga, the same local micro-finance institution, to help administer the loans. However, this time, the number of loans was expanded to include all 11 sub-locations. Saga had no previous experience with such a large client base and therefore relied heavily on Millennium Farms for building its capacity to handle this increase in loans.

By early 2008, political upheavals in Kenya arising from the December 2007 presidential elections had sparked violence and unrest in many areas. Across the country, farmers were displaced and businesses were affected. Prices of inputs rose sharply and distribution channels for inputs were disrupted. Siaya was heavily affected by these national events and many agro-dealers went out of business. Therefore, instead of rebuilding the agro-dealer networks in the sub-locations, Millennium Farms took over the distribution of the input packages to farmers. Even though MVP had invested

in setting up these agro-dealer networks in 2007, changes in MVP programmatic direction from headquarters in New York, coupled with Kenya's national political realities, forced MVP to abandon their agro-dealer programme and begin a new input supply and distribution system. According to Willy Diru:

> *The post-election violence had a devastating effect on the agro-dealers in the MVP area. The agro-dealers we set up in the cluster are just out of business.*[87]

Therefore, the programme stopped using agro-dealers because the post-election violence had disrupted the distribution networks and an alternative was needed quickly. Yet, due to administrative issues associated with setting up a new entity and a new system of operations, Millennium Farms did not become operational until March 2008. The late start coincided with the onset of the long-rains and a crucial time for planting. In Willy Diru's view, this led to a precarious situation that forced the project to implement the new programme in the quickest way possible:

> *Because of the political upheavals, there was not sufficient time to phase in the credit programme gradually. We were in a rush to get started and to give the farmers the inputs.*[88]

The short timeframe available for distributing inputs to the farmers in time for the planting season meant that communication concerning the credit scheme had to take place very rapidly. Many of the procedures surrounding building farmers' groups and verification of credit worthiness were not accomplished. Every household within the MVP area was automatically eligible for a loan. Saga was given a list of households and no other screening, appraisal or credit checks were made. Farmers were able to request a loan package ranging from US$50 to 200. Approximately 7,300 out of 12,700 (around 57 percent) of households in the 11 sub-locations applied for loans with Saga.[89] The farmers received a voucher from Saga indicating the amount of the loan and they could redeem this voucher for farm inputs from Millennium Farms directly. Millennium Farms brought the fertilisers to central depots previously used by MVP to distribute the free inputs and farmers went to these designated pick-up spots.

[87] Interview, Willy Diru, MVP Agriculture Coordinator, Kisumu, May 7, 2010.
[88] Ibid
[89] Interview, Anginya Tabu, Programme Coordinator, Millennium Farms, Kisumu, April 17, 2009.

Since the loans were a relatively new process for the outlying clusters, MVP held many meetings to explain the process to farmers. However, even with numerous information sessions, the research found that the short timeframe caught many farmers off-guard. Farmers interviewed expressed concern about the change in direction from subsidies to a credit system and the limited advance warning they were given. The farmers in the lower wealth category were much less aware of the changes. As stated by one respondent:

> *MVP should be announcing to farmers issues related to programme changes, such as coming up of loaning institutions, in advance so that we have time to prepare and to re-organise our decision making. We were given too short notice when this happened and many farmers were unsure of what to do.*[90]

This disconnect between the MVP staff understanding of the process and dissemination of information led to confusion and frustrations among farmers. MVP's shift in direction from a long-term full subsidy programme originally conveyed to the community, combined with the rapid expansion of the project to 10 additional locations, affected the relationship between the project and the communities. The relation between the networks of actors involved also shifted. The shift in input suppliers from direct project distribution to agro-dealers to wholesale distributors (such as Millennium Farms) was an important determinant in restructuring the socio-technical system in fundamental ways. The creation of new actors generated new trust issues and changed power relations, which affected access to and delivery of the technology. Furthermore, the project suffered from the wider political turmoil associated with the post-election violence, demonstrating how larger national-level political forces can affect micro-level socio-technical structures.

Uptake and repayment of the micro-credit programme

Of the recipients interviewed, 53 percent reported taking the Saga loan through Millennium Farms. The majority that took loans (68 percent) were in the highest wealth category (Category A). These households have multiple plots of land and multiple sources of income (especially from remittances) that can be relied on as a safety net for loan repayment if the need arises. One well-off female farmer reports:

[90] Interview, male farmer, wealth category B, Sauri, Siaya, May 18, 2009.

> *I thought that if I get the loan I could get a good harvest and sell it to repay the loan. I harvested 18 bags from all my plots, and sold five bags to repay Saga. I even had enough money saved from my previous harvest to hire extra land and labour to make sure I got a good harvest so I was able to clear my Saga loan.*[91]

Of the 47 percent of households that did not take the Saga/Millennium Farms loan, most (82 percent) came from the middle and lowest wealth categories (Categories B and C). The reasons for not taking the loan included a fear of loans and that they would be unable to repay the loan. One farmer observed:

> *I assessed my situation and realised that I would not be able to repay the loan and I worried about that repayment, so I did not take the loan.*[92]

However, there was some miscommunication, with at least three widows from the lowest wealth category not taking the loan because they assumed they were still eligible for subsidised inputs. Once they realised that they would not receive inputs, it was too late and they were unable to participate in the loan programme. One widow describes what happened:

> *I thought my name would be on the list of vulnerable because I was told that all widows would be on the list by the village elders. Therefore, I waited to see if my name was on the list and it was not. By then I had missed signing up for Saga and I was not able to take the loan.*[93]

Besides a fear of defaulting and confusion over eligibility, many other social factors featured in the decision-making process. There were indications that some village leaders were pressuring farmers who had decided not to take the Saga loan. Village elders and agriculture representatives mentioned at focus group meetings how they went to homesteads in their village to ask why someone was not taking a loan. These household visits resulted in some farmers, especially in Lihanda, feeling coerced into taking a loan. These social pressures were felt within all wealth categories. Beatrice, an elderly widow from the highest income category, explains:

[91] Interview, female farmer, wealth category A, Nyandiwa, Siaya, May 11, 2009.
[92] Interview, female farmer, wealth category B, Lihanda, Siaya, May 26, 2009.
[93] Interview, female farmer, wealth category C, Lihanda, Siaya, May 6, 2009.

> *I was told that whether we like it or not that we had to take a loan. The Assistant Chief and the village elders were going house-to-house to tell us to take a loan. I was afraid of a loan. However, I was not feeling free, I felt forced to take a loan.*[94]

Beatrice had never taken a formal loan before and had many reservations, yet she took the loan after being approached by the Assistant Chief. She explained how she felt obliged to listen to the village leaders and decided that it was better to go along with their request than go against it. Because she came from a well-respected homestead, she was more inclined to follow the social pressures exerted by the village elders and since she was part of their social network she had more to lose by not doing as they asked.

However, Anginya Tabu, MVP staff member who worked for Millennium Farms, questions the validity of these claims of coercion and states that farmers often report being compelled to take the loan when they find they cannot pay it back. He argues that farmers were using the excuse of coercion and social pressure as a justification for non-repayment. According to Tabu, the role of the village leaders and Assistant Chiefs was to raise awareness of the loans, not to force members to take the loan. Therefore, MVP staff members see this social pressure as a distortion of their message.[95]

Another factor that led some farmers to take the loan was the close association with the MVP subsidy programme. During one interview, a farmer discussed how she had been originally against taking the loan, but then she heard from a neighbour that it was a "loan from Millennium" and not to worry if she could not pay it back. Another farmer states:

> *The loan was the first one I have ever taken. I was told by the Assistant Chief that every household must take a loan. Therefore, I decided to take the loan. Initially I was not willing but since everyone was taking it, I thought I should too.*[96]

The move from universal subsidy to a credit programme was not well received by respondents, who felt the project had not upheld its promises. Farmers expressed the

[94] Pseudonym used. Interview, female farmer, wealth category A, Lihanda, Siaya, May 5, 2009.
[95] Interview, Anginya Tabu, Programme Coordinator, Millennium Farms, Kisumu, April 17, 2009.
[96] Interview, female farmer, wealth category A, Lihanda, Siaya, May 4, 2009.

opinion that the initial communication from MVP indicated that the subsidy would run for five years. One farmer articulated it in the following manner:

> *Two years is not enough. We were told we would be given fertiliser for free for five years. We had expected Millennium to be five years so we were not prepared. If we had been told it would be one or two years from the beginning, then we would have been prepared.*[97]

Another farmer stated that the change in policy was not explained adequately:

> *When Millennium came in 2005, there was communication that this assistance would be for five years. Nobody gave us a good explanation why this aid was no longer for five years.*[98]

While some farmers may have felt inadequately prepared, MVP staff member Jessica Masira (Community Coordinator at that time) reported that they conducted extensive information activities and follow-up meetings to reinforce understanding of the loan agreement. Farmers interviewed concur that they had been part of meetings to discuss the nature of the loan and repayment schedules. Farmers stated the loans issue became a regular topic of discussion at their *barazas* (village meetings). Therefore, the information was being presented, but the extent to which misinformation occurred or social pressures played a role in persuading members to sign up to the loan remains unclear and would require further analysis into the decision-making process and effects of social pressures from within the community.

Once farmers had signed up for their loans and planted, they were to repay their loans after they had harvested their crops. One component of the credit programme was that repayment was to be made to Millennium Farms, not to Saga, the micro-finance institution. Repayment was to be in the form of maize at the time of harvest. Millennium Farms set the repayment ratio based on a predetermined price of maize and then tagged it to the amount of loan taken by the farmer. For example, one bag of maize (90 kilograms) was worth approximately US$14. Therefore, if the farmer received a loan for US$90, then the farmer was to repay seven bags of maize.[99] This calculation

[97] Interview, female farmer, wealth category A, Lihanda, Siaya, May 13, 2009.
[98] Interview, male farmer, wealth category C, Sauri, Siaya, June 4, 2009.
[99] Since describing yields in terms of bags of maize per hectare is a common practice in Kenya, it was used as the measure for repayment as it is easily understood by farmers.

also included the interest on the loan. Millennium Farms would store the maize and sell it at a higher price later in the season. It was expected that the profit from the sale of maize would create a viable business model, allowing the loans to be carried on the following year.

However, after the harvest in 2008, the market price of maize exceeded the rates agreed by Millennium Farms with the farmers at the beginning of the year. This led many farmers to sell their maize to resellers who were offering better prices. Farmers then asked to repay the loan in cash instead. Millennium Farms initially refused the cash repayment, but later changed its policy to meet the farmers' demands, reducing the number of bags required for repayment. This only increased the farmers' confusion since now some farmers were repaying less than those who had repaid earlier. To add to the difficulties, farmers complained that unfavourable weather had affected their yields, which were now too low to allow them to repay in full. One farmer describes the list of problems encountered that season:

> *My yield was very bad. The seed was bad and many people complained. The time of distribution of inputs was late. In addition, we had some bad weather and animals disturbed the crops. I only harvested one and a half bags on my quarter acre, so I sold half a bag and paid back a portion of the loan. I was not able to clear the loan with Saga.*[100]

Even after MVP staff organised numerous community meetings, a high outstanding default rate remained and repayments from the 2008 credit programme were much lower than Millennium Farms had anticipated. By April 2009, only 40 percent of all farmers had repaid the 2008 loans.[101] MVP instigated an internal study to investigate the reasons for the low repayment rate, but they have yet to release the results. According to Anginya Tabu, one of the main problems was:

> *Everyone qualified for the loans so there was no collateral and no appraisals done. This should have been done and not everyone should have been given loans. Therefore, farmers took loans without consequences, so there were no incentives to pay back.*[102]

[100] Interview, female farmer, wealth category B, Lihanda, Siaya, May 9, 2009.
[101] Interview, Anginya Tabu, Programme Coordinator Millennium Farms, Kisumu, April 17, 2009.
[102] Interview, Anginya Tabu, Programme Coordinator Millennium Farms, Kisumu, April 17, 2009.

According to Tabu, the sub-locations with the lowest repayment rates were those in which the village leaders and elders did not repay. He assumed this was a significant factor, as it was difficult for MVP to ask the village leaders to use social pressures to persuade people to repay when the leaders had not yet repaid.

Patrick Mutuo (previous Team Leader for Sauri) lists two main reasons for the low repayment rate. First, the heavy involvement of the project in the loan programme made it difficult for farmers to disassociate between the project and the loans. Many staff members from Millennium Farms were also working with MVP, and MVP staff often delivered the messages about the loans. The farmers knew the project would have little power in enforcing repayment, so there was little risk associated with non-repayment. Second, farmers generally failed to understand how the credit system worked. The rush to implement the programme resulted in insufficient training and the farmers failed to realise that timely repayments would allow them access to future loans. This was seen as a short-term project that required no commitments and had no repercussions or benefits in the future.

This brief analysis of MVP's evolving credit system demonstrates how external forces, due in this case to the post-election instability, can de-rail planned activities. In this case, the MVP administrators quickly changed the input-support model without putting in place adequate training and procedures to allow staff to explain changes to the farmers. This led to a lack of understanding among the farmers and changed the dynamics of the relationships. Local leaders became more involved in the process and were able to use their authority to influence farmers' involvement in the programme. This relationship between the local powers and the community created a new dynamic in the socio-technical system, and ultimately created further tensions within the villages and with the project. MVP was aware of the shortcomings of its credit programme, which was evident through the poor repayment schedule and the social tensions it created, and once again adjusted the programme. The socio-technical system was thus evolving continuously in response to the wider system, which included credit finance, agro-dealer capacity and relationships between communities and the project, as well as to the technologies themselves.

Changing to commercial credit

The following year (2009), MVP changed the system again and took over the input delivery programme once more. MVP closed down its operations within Millennium Farms and ended its partnership with the micro-finance institution, Saga. Instead, MVP started a new credit programme by linking with Equity Bank, a large and well-established commercial bank, to administer loans to those who qualified. MVP worked with the development organisation AGRA to support credit guarantees to Equity Bank and encourage the bank to offer loans to the farmers.

MVP and Equity Bank put new loan criteria in place. MVP stated that only farmers who had cleared their previous loans to Saga in 2008 were eligible for the loan. Even partial repayment of the loan was not admissible. These strict criteria meant that only 1,500 farmers out of a possible 12,700 were eligible for loans. No other loan package was offered to the farmers who did not qualify. Farmers who were entitled to the loans had mixed feelings. Some welcomed the new structure, since Equity Bank offered new options of savings accounts and other loan products. Others mentioned that they chose not to take the loan since Equity Bank had too many conditions and they feared they could lose their lands if they did not repay the loan. Approximately 916 farmers (61 percent of those that qualified and roughly seven percent of the entire MVP cluster population) took the Equity loan in 2009.[103]

One poor female farmer from Lihanda described how she felt excluded from the new loan programme:

> *I would have liked to continue to get another loan but I could not because I had not cleared my Saga loan. However, I did struggle to pay almost half of that loan, and now it does not matter how much I struggle to clear it. It is not very fair as I was willing to be in Equity but I did not qualify.*[104]

This rapid change to include Equity Bank as the new credit provider was difficult for both the farmers and MVP field staff implementing the project. While Saga, the smaller micro-finance institution, had problems with capacity, it had allowed MVP staff control

[103] Interview, Anginya Tabu, Programme Coordinator Millennium Farms, Kisumu, April 17, 2009.
[104] Interview, female farmer, wealth category C, Lihanda, Siaya, September 2, 2009.

over the process and the staff had grown familiar with Saga staff. The initial year of the new programme presented challenges as MVP staff adjusted to the new structure and requirements. The selection criteria were set by MVP staff in New York and did not have full agreement from the field staff in Kisumu. As one senior field officer stated:

> *I do not agree with the 100 percent cut off for repayment to get the Equity loan. I would have liked the cut off to be around 65 percent, which shows to me a commitment to repay. However, New York was strict on the 100 percent repayment criteria. It cut off so many people from receiving assistance.*[105]

At the time of this research, the full numbers of the repayments had not been calculated. However, indications were that 2010 repayments were much higher than those of the previous season. This is to be expected as farmers took the loan from Equity Bank much more seriously. However, with only seven percent of the MVP cluster taking part in this lending scheme, the scheme's overall impact on alleviating food security in the area is questionable. The majority of the food-insecure farmers are in the lower wealth categories that did not take part in the Equity Bank credit programme. Therefore, the network of actors taking part was restructured again, especially when the project changed its plans to outsource the delivery of finance and technology without full consultation with the community. Such frequent restructuring of the relationship between actors has had negative impacts on the overall system of trust, power, politics and relations.

Choosing the vulnerable

While the majority of households were no longer eligible for subsidies or loans under the 2009 commercial bank credit system, the MVP still operates a targeted subsidy programme for farmers listed as vulnerable, aimed at the poorest 25 percent of the entire population. The local agriculture committee members put the targeted lists together by asking each village to name the most vulnerable members of their communities, based on criteria provided by MVP. Once the list was compiled, MVP and the agriculture committee held a general farmers meeting during which the community could discuss and finalise the list.

[105] Interview, MVP field staff, Nyandiwa, Siaya, April 23, 2009.

However, it is difficult to ensure transparency and accountability in implementing such a system, due to existing power relations and the status of various community members. According to Florence Ashioya, MVP's Agriculture Facilitator for Lihanda, the process of leaving it up to the community to decide on the list of vulnerable had its difficulties:

> *That selection is a bit tricky because even during the selection, we may not know the real vulnerable so we rely on the community to give us those who are vulnerable and they do not always give us the real vulnerable. They give us some people who are a little bit well off, depending on how they relate with the community. Therefore, it is a bit tricky, it may not work 100 percent if we were to go out looking for these vulnerable people and if you get a real vulnerable person, these are guys who do not even mix with others. If you go talking to that person, he may not even listen to you.*[106]

Willy Diru also mentioned the problem of social pressures brought on by some village leaders who may push certain members to be part of the vulnerable list:

> *There is one sub-location where the Assistant Chief is much more outgoing and he will bring in those people he considers vulnerable. Once we subject it to that general meeting sometimes you can have the community feeling intimidated with who the Assistant Chief has brought on the list. But this happens only in one sub-location, in the rest of the sub-locations the Assistant Chief will just sit there as a participant.*[107]

Nevertheless, MVP staff members were readily available to investigate any discrepancies and address problems that arose with the subsidy programme for the vulnerable. This constant monitoring helped the programme run more smoothly. While it did not eliminate all the community criticisms, close monitoring of the process did help to ensure that the community and project staff vetted the list, thereby improving the targeting process.

However, targeting the vulnerable based on criteria developed by MVP once again restructured the local socio-technical interface by defining a particular group (i.e., the 'vulnerable') within the community that had not been defined during the original inception of the programme. The politics of defining this group – and so providing

[106] Interview, Florence Ashioya, Agriculture Facilitator, Lihanda, Siaya, October 21, 2009.
[107] Interview, Willy Diru, MVP Agriculture Coordinator Interview, Kisumu, May 7th, 2010.

them with access to inputs – ensured that community politics (and elite manoeuvres) were able to exert a degree of control. The impacts of this are highlighted in the next section, which provides a deeper analysis of how the programmatic changes and challenges of the input-support system affected the household-level narrative.

The outcome of the programme

As the previous sections have shown, MVP's input-supply programme shifted, from providing a universal subsidy, to a targeted subsidy programme, followed by a formal credit system. At the same time, there was a focus on training in such complementary technologies as crop diversification and improved fallows. The content of the package given to farmers also changed over the course of the project and included fertiliser and seed together with extensive training on planting and soil management techniques (i.e., spacing, agro-forestry, improved fallows and green legume crops). With such a range of interventions, the perceptions of the input-support programme are often tied to the entirety of the MVP activities.

As stated earlier, Siaya is a food-deficient area with the majority of households being net buyers of food. A large proportion (86 percent) of the farmers interviewed did not produce enough maize to feed their families and had to buy maize for at least five months of the year. However, all households interviewed stated that when MVP began to distribute the subsidised input packages, they experienced increases in their yields. As a farmer from the middle wealth category explained:

> *Life is now different from before MVP. Food security is there. Before MVP we could only have maize for a short time and we bought maize, but now we have enough food.*[108]

When the MVP input-subsidy programme stopped, the majority of farmers (97 percent) reported a decrease in their yields compared to when the subsidy programme was operating. This affected their food security status and, by 2010, they again began to purchase maize for part of the year.[109] However, half of the farmers reported a shorter

[108] Interview, male farmer, wealth category B, Nyandiwa, Siaya, September 17, 2009

[109] It is important to note that yields are affected by many other factors, including rainfall. The country experienced a prolonged drought in many areas from 2007 to 2009. And while the 2009 long rains were

maize-deficit period of around three–four months in March–June. The remaining half stated that they had returned to the same level of food insecurity as they experienced prior to the MVP interventions. This observation is supported by a study that measured farmers' perceptions of the food security situation before and after MVP interventions. That study interviewed 246 respondents from Sauri and found that 54 percent of respondents felt they were now more food secure than prior to the MVP interventions, while 46 percent reported remaining food insecure (Okoth, 2010: 63).

From the farmers I interviewed, the group most affected by the decrease in subsides was the widows from the lowest wealth category. The comments of two poor widows from Lihanda illustrate their views:

> *In the first two years of MVP, my life changed, but in the last two years, my life is back to where it was. I only benefited from two years of good harvests, and I did not invest in anything else. At least my children get school meals from Millennium's school feeding programme so they do not disturb me for meals at home. That is the only positive thing I have seen.*[110]

> *I would say I was food secure for the first two years. But I am not food secure at this time. I started having problems last year when Saga came. I did not take the loan and the yield was low because I was unable to purchase inputs.*[111]

Helen Anyango is one of these poor widows who did not managed to retain the advances she made during the early years of the subsidy programme. Helen became a widow at the age of 24. She has not remarried and lives in her husband's family compound with her four young children. She has approximately 0.30 hectares of land to sustain her family. She had never used inorganic fertiliser before Millennium and depended mostly on household and farm waste that she mixes into compost. While she owns only a few chickens, she is allowed to gather some manure from her mother-in-law's livestock, but only if her mother-in-law does not require it and if there is any left for her to share. Most times Helen does not use anything on her land. The highest yield she received was two bags of maize. This is not enough to feed her family so she depends on handouts from her relatives in the compound.

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considered average, the rains in 2010 were much more variable, with heavy flooding in the early part of the year (March) and then failing of the short-rains (Oct/Nov), which heavily affected yield rates for many farmers in that region (GOK, 2010d).

[110] Interview, female farmer, wealth category C, Nyandiwa, Siaya, April 27, 2010.

[111] Interview, female farmer, wealth category C, Nyandiwa, Siaya, April 28, 2010.

When MVP came, Helen was given the input package and her yield jumped from two to six bags of maize; during the second year this increased to seven bags. She had never received such high yields before and she says that her life had changed. She had a few reservations about the DAP since she had never used it before, but when she saw everyone in her village using the package she decided it must be a good thing. After two years, she noticed the change in her yields. However, by the third year, she was not given free inputs and she did not take the loan offered by Saga. She knew that in her unstable financial position she would not be able to pay back the loan so she decided against it. She did not purchase any inputs that year and her yields dropped back down to 1.5 bags of maize.

Farm visits to her fields that year showed how poorly her crops were doing next to those of her in-laws. Helen's small land area was covered in weeds and over-run by *Striga*. The crop was barely visible. She explains that she must work on other people's lands to get a little income to support her family, leaving her very little time to weed her own plot. She has no labour to help her, so her land is left largely unmanaged. By the fourth year, Helen had decided not to plant during the long rains and is concentrating on planting beans for the short rains. Initially she says she decided to 'rest' her soils but then admits she has been too busy working on other farms this year to plant her own plot. She earns very little (approximately US$1/day) for a full day's work and her food security situation is precarious, at the same level as it was prior to MVP's interventions.

Figure 15: Helen Anyango showing her fields destroyed by *Striga*

Helen wants to change the way she manages her land. She received training from MVP and she recognises the benefits of maintaining the health of her soil. However, she has no savings to invest in her small farm. The most she has saved is US$8 and she needs to spend that on her four children, for food, school and other necessities. Locked out of the latest loan programme, and with only her own labour, she cannot afford to buy farm inputs. She says:

> *The two years was not enough time for me to stabilise myself to start saving. If it could have been for five years, at least I could have saved something*". [112]

Helen illustrates the challenges facing many poor widows. She was given only a small piece of land by her late husband's family and receives very little support in terms of labour or inputs from his family. Despite seeing the benefits of fertiliser on her yields, the yield increases over two years were not enough to allow her to start saving and purchasing inputs on her own. The risks associated with such a small land parcel of poor quality (as evident by the overgrowth of *Striga*), force Helen to offer herself as labour on other farms to earn an income, which she views as more stable than relying on her own plot to sustain her family. She is also locked out of the loan offered by Equity Bank, since she has no credit history (she did not take the Saga loan) and therefore has very little options for purchasing inputs. While she benefited from two years of inputs and training, once that was finished her food security situation reverted back to it former level.

However, not all MVP farmers experienced such a reduction in their food security status when the subsidies finished. Of the farmers interviewed, 22 percent (eight respondents) felt that MVP had a positive impact. These farmers came from different wealth categories, including 50 percent (four respondents) from wealth category A and 25 percent (two respondents) from each of the lower wealth categories B and C. These farmers experienced productivity increases as a result of several factors introduced by MVP, including increased use of fertiliser, training on planting methods and diversification to higher value crops. One male farmer from the middle wealth category describes how his other activities are helping him improve his food security situation:

[112] Series of interviews with Helen Anyango, Nyandiwa, Siaya, May 2009 – June 2010.

> *Since Millennium came the one thing we got is food security, even if maize production goes down, I have other things to boost me.*[113]

George Opondo is another farmer who has managed to incorporate the subsidy with other activities to change his food security situation. George comes from the lowest wealth category and lives at the top of a rocky hillside in Lihanda with his two wives and fourteen children. The three houses in the compound are built in the traditional manner with mud walls and thatched roofs. He owns about 1.6 hectares but most of the land is rocky and steep, with half the area set aside for maize. Prior to MVP, George applied cow manure collected from his three dairy cows. He used to average four to five bags of maize per half a hectare. The maize was strictly for household consumption, and he relied on selling milk and tomatoes for his main income. Before MVP, he had experimented with inorganic fertiliser applied to his tomatoes but he had never used it on his maize. When MVP came in 2006, he was given 30 kilograms of DAP and 30 kilograms of urea along with some maize seed. He used that on 0.4 hectares of land and harvested almost 14 bags of maize. George states:

> *I got the best yield of my life that year. I sold three bags to pay for school fees, I gave one back to the project and we consumed the remaining 10 bags.*[114]

The next year (2007), MVP gave him the same amount of fertiliser and George decided to buy more. He purchased an additional 25 kilograms from a local shop in Luanda and rented a small portion of land (approximately 0.10 hectare) to plant more maize. This time he harvested 18 bags. The following year, 2008, he decided to take a loan from Saga worth 70 kilograms of DAP. He used the inputs on roughly one hectare and harvested 32 bags. With this harvest he was able to clear his loan with Saga and have enough left over for his family.

In 2009, the MVP loan programme changed from Saga to Equity Bank. Even though George would have been eligible for a loan, he decided against it. He explains:

> *I did not take the loan that year. I was so stressed the last year with repayment and I just wanted my mind to relax this year, so I did not take the loan. If it was another loaning institution, other than Equity, then yes. But Equity, no.... When*

[113] Interview, male farmer, wealth category B, Lihanda, Siaya, September 3, 2009.
[114] Series of interviews with George Opondo, Lihanda, Siaya, May 2009 – June 2010.

> *deadlines reach Equity, they do not listen even if a relative died they will come and take things from your home.*

Therefore, George decided to forego the loan and instead he purchased 20 kilograms of DAP from the local market in Luanda. The quantity of inputs was much less than he had used the previous year, but he defends his decision:

> *I used 20 kilograms of DAP and combined it with animal manure for part of my land. I know DAP is good for the soil but it is very expensive and manure from my cows is free.*

However, that year (2009), George's yield was not as good as the previous three years and he harvested 11 bags of maize. He blames the drought and the fact that he did not have enough manure. However, he is not downhearted:

> *Farming is a funny enterprise; sometimes you are up and sometimes you are down. But because I have a large family, I have to buy at least some fertiliser to get enough maize to feed my family. However, even if my maize production goes down, I have other things, such as my cows and my vegetables that will boost me.*

The last visit with George (in June 2010) revealed that he has continued to diversify his crops while still focusing on his tomato- and milk-producing activities. He has received additional training from MVP on both of these activities and his production continues to improve. George feels that these activities will allow him to earn enough to purchase fertiliser. He plans to sell one cow and buy at least 50 kilograms of fertiliser. He feels that fertiliser is important to improve his maize production and will help put all his children through school.

George exemplifies how a farmer uses complementary technologies and a diversified production strategy to spread some of the risk associated with rain-fed agriculture. Over the past seven years, George has lost cattle to disease, tomatoes to blight and maize to a range of pests and diseases as well as to drought. Therefore, spreading risk becomes an ever-important food security strategy. In addition, George owns two hectares of land, which allows him the opportunity to experiment with new technologies. He has the space to plant on half his land and leaves his cattle to graze on the remaining half.

These activities have also allowed him to earn money to pay for additional labour and to rent more land to expand his activities.

Perceptions and adaptation of technology package

While some farmers experienced variation in the quality of the seed and fertiliser they used over the last five years, every household that I interviewed held an overall positive opinion of the need to use the inputs (improved seed and fertiliser) delivered by MVP. As stated previously, before the arrival of the programme, few farmers in the area had knowledge or experience with inorganic fertilisers. Therefore, MVP spent a considerable amount of time training them on how to use the technologies and on improving their farm management practices. The training was successful in changing farmers' perceptions on soil management and the role of fertiliser (see Chapter 5). A young male farmer from Lihanda explained how his preconceptions about what inorganic fertiliser might do to the soil had been altered:

> *Before Millennium there was this kind of belief that when you use fertiliser it depletes the soil. But now I am not seeing that. I have realised since using fertiliser that it is good. If I stop using it then I will not get a good harvest.*[115]

Another male farmer also described how the community had worried about the ill effects of fertiliser and the change he has seen in the community:

> *After applying the fertiliser they were given by Millennium, the results made them realise the importance of fertiliser. Before Millennium, most people were planting without fertiliser. They had a feeling that fertiliser was not good for the soil; that other weeds like Striga start spreading in the field when you use fertiliser. Since Millennium, I have seen the importance of fertiliser, and that is why I now try to use it.*[116]

Other farmers mentioned that, while they may not buy inputs without the subsidy programme, they have changed their planting methods, through spacing or other management techniques learned through MVP. Some farmers are now planting in a line rather than broadcasting their maize seeds. Others talk about new spacing and weeding methods. All these new techniques have enabled farmers to alter the management of

[115]Interview, male farmer, wealth category B, Lihanda, Siaya, May 6, 2009.
[116]Interview, male farmer, wealth category A, Nyandiwa, Siaya, May 11, 2009.

their farms and, along with the use of the input packages, have helped many of them to increase their yields, particularly of maize.

Incorporating elements of the input-support programme with additional knowledge and technologies presented by MVP results in the creation of 'experimental niches', which facilitate local innovation by altering and combining promising new technologies and concepts (Moors et al., 2004). These niches provide the farmers with new models for understanding and using the technology (cf. Kemp et al., 1998; Rip and Kemp, 1998; Hoogma et al., 2002; van der Ploeg et al., 2004). It is within this niche that "actors are willing to invest significant time, effort and financial costs in testing, or making improvements to the promising practice or new technology" (Adey, 2007: 34). Therefore, farmers have adapted the technologies and combined them in a unique form to suit their particular farming realities (both ecological and economic).

While some of the larger-scale and wealthier farmers stated that they had been using inorganic fertiliser, the majority of the households in the middle and lower wealth categories did not use any or used very little (i.e., 5 to 10 kilograms) prior to the project. Every household in the 11 sub-locations experienced the technologies over at least three to four years through the subsidy and credit programmes. The resulting increase in yields, especially during the first two years, meant that farmers were able to experience real changes on their farms over this timeframe. However, the question remains whether or not these results are sustained after the subsidy has passed and whether the farmers would use the inputs at the dosage rates recommended by the programme.

MVP has made some efforts to track the use of inputs within the MV1 (Sauri) since the end of the input subsidy programme. According to the Sauri Annual Report (Millennium Villages Project, 2009: 4), data collected indicated that:

> *... out of the 1,160 households, 324 [28%] used local seed and no fertilizer or very little fertilizer; another 156 [13%] used only DAP and no top-dressing. A total of 300 [26%] households bought the full complement of fertilizers*[117] *and recommended inputs.*

[117] While not stated in the passage, based on field discussions with MVP staff a "full complement of fertilisers" consists of 50 kilograms of DAP and 50 kilograms of urea for 0.4 hectare of land.

While this research had a much smaller sample size (36 MVP households), the qualitative case study-oriented approach was useful to delve deeper into the socio-economic realities of the people's lives and their decision-making processes. These results are used to present more textured information about people's engagement with the inputs and offer some insight into the results outlined in the larger sample size.

For example, in 2010, 67 percent of households interviewed purchased inputs, 14 percent were on the vulnerable list and 19 percent of households did not purchase any inputs. In terms of gender differentiations, male-headed households purchased inputs at a higher level (58 percent) than female-headed households, with remittances from off-farm labour and diversification into other crops (such as vegetables and beans) playing an important role in income generation in 75 percent of these female-headed households. Of those who bought fertiliser, 36 percent came from the top wealth category, 36 percent from the middle, and 28 percent from the lowest. The majority of households that received inputs via the vulnerable category were female-headed households (80 percent), all from the lowest wealth category. The majority of those that did not use inputs were female-headed households (86 percent).

While these numbers present a picture of the purchases made in that year, they do not describe whether or not farmers have adopted, adapted or rejected the input packages. What the research shows is that an array of different behaviour shifts has occurred. These shifts are a product of the different social worlds of diverse people, differentiated by wealth, age and gender, and how they cope with a predetermined technology package. While their responses to the technology package are extremely varied, the respondents can be divided into four categories: a) those using fertiliser prior to the programme; b) those not using fertiliser before but who have continued to use it after the programme; c) those not using before and who are still using in limited amounts; and d) those not using before who are not using now.

The first group (40 percent of all households) represents the respondents that were using fertiliser prior to the programme. This group is evenly divided between male and female-headed households. Before the MVP interventions, their purchases were very small and irregular, with an average of 5–15 kilograms of fertiliser a year. Only two

households purchased DAP at close to the rates recommended by MVP. By the end of the MVP programme of subsidies, 80 percent of the farmers in this group continued to purchase inputs. Most of them have increased the quantity they use and are now purchasing between 25 and 50 kilograms per year.

The most important transformation mentioned by members of this group has been their inclusion of other practices, such as diversification of crop production, which has led to reduced dependence on maize. Therefore, they have been able to invest in other parts of their farms, spreading the risk between other crops and activities. Out of this group, 20 percent did not continue to purchase inputs after the subsidies ended. They are all female-headed households but have different reasons for not purchasing inputs, which include personal tragedy (the death of the main income earner), diversification out of maize and health-related issues that affected their ability to farm. The following stories illustrate this group[118]:

Jacqueline is a young widow from the poorest wealth category in Nyandiwa. She farms 0.2 hectares and rents an additional 0.2 hectares from a neighbour. She rarely produces enough to feed herself and her five young children. Jacqueline's husband used to work in a neighbouring town as a day labourer and the family depended heavily on his income. Jacqueline would purchase small amounts of fertiliser from a local market in Nyangweso. However, even with the fertiliser, her highest yield was four bags of maize. In 2006, MVP began the input-support programme and Jacqueline received 40 kilograms of DAP, 40 kilograms of urea and eight kilograms of hybrid maize seed. In 2007, when MVP switched to the loan system with Saga, Jacqueline was too afraid to go for a loan and did not apply. Unfortunately, this also coincided with the death of her husband. Without her husband's income, she has not been able to make ends meet and she was unable to purchase inputs. In 2008, Jacqueline was put on MVP's vulnerable list and she received a small package of inputs (25 kilograms of DAP, 25 kilograms of urea, six kilograms of maize seed). At the last visit (June 2010), Jacqueline was still on the vulnerable list but she had joined a women's savings group and was hoping to save enough to purchase some inputs for the next long rains.

[118] The following represents a series of interviews with women-headed households in all three wealth categories (A, B, C) in the three sub-locations between May 2009 and June 2010.

Sulmena comes from a middle-income household. She had used fertiliser a couple of times before MVP. After two years of receiving the subsidy package (2005/06) and one year of loan from Saga (2007), she decided not to purchase inputs in 2008. Instead, she decided to expand her planting area by renting additional land. According to Sulmena, her fields are very poor quality (the area is very hilly and rocky) and she cannot depend on her farm as her primary source of income. Therefore, she depends on income from many off-farm activities, such as charcoal production and selling vegetables and local brew. She recently joined a group of women to make and sell local brew in the area and spends most her time in that activity. Therefore, Sulmena believes that growing maize is not a priority and that the investments needed to improve the yields are too costly. She says she uses her income from other sources to make up her deficit in maize.

Elisabeth is the third and youngest wife from a wealthy polygamous homestead in Sauri. Her husband worked in a neighbouring town and regularly purchased inputs for the family. In 2005, MVP started in Siaya and Elisabeth received 300 kilograms of DAP. Her yield increased from 10 to 35 bags of maize on one hectare. The next year (2006), she received 150 kilograms of DAP and her yields were slightly down to 25 bags. She says the reason was that the fertiliser was not enough and she 'under-dosed'. In 2007, she applied for a Saga loan for 100 kilograms DAP, and she harvested 20 bags. However, that year her husband passed away and Elisabeth spent most of her money on funeral expenses. She also became sick, which left her little energy to work her farm. In 2008, she did not buy any inputs and planted only a small area. Her yield dropped to eight bags. Then in 2009, without inputs and with increasingly poor health, she managed to harvest three bags of maize. Due to lack of labour, most of Elisabeth's land remains idle. Her social situation, being the youngest (third) wife of a polygamous homestead, means that Elisabeth does not have access to the same social support networks that are available to the older, more senior wives on the compound. Therefore, even with the subsidies she received from the programme, other factors such as health and socio-economic standings have affected her ability to adopt the technologies.

The second group (26 percent of all households) consists of those households who had not used the technology package prior to the MVP and yet have continued to purchase inorganic fertiliser (DAP) after the subsidy programme ended. The majority of these

households (67 percent) were male-headed. The wealth categories were split evenly between the wealthier, middle-income and poorer households. Many farmers in this group took advantage of Kenya's national subsidy programme to purchase 50 kilograms of DAP from the NCPB at reduced rates. Dismas Okello exemplifies this second group and his story follows.

Dismas is a young well-off farmer from Nyandiwa. He lives in his father's compound with his wife Eunice and their two small children. When Dismas' father divided his 2.4 hectares of land between his sons, Dismas, being the eldest son, received half of the land (approximately 1.2 hectares). At 28 years old, Dismas is an experienced farmer and enjoys experimenting on his farm. However, he leaves the majority of the farming activities to his wife, so that he can earn additional income in nearby villages doing masonry work and other jobs. When MVP came into the area, Dismas received the inputs and training. His yields in the first two years were much better than before. He repaid 20 kilograms of maize to the school feeding programme run by MVP and sold two bags to pay for household items.[119]

Figure 16: Dismas Okello and his children, Siaya, May 2009

However, when the subsidy was replaced with the credit programme, Dismas turned down the loan and borrowed some money from a friend to buy 50 kilograms of government-subsidised fertiliser from the NCPB in Yala at Ksh 3,500 (approximately US$46). He was able to harvest enough to repay his friend, feed his family and sell some maize. In 2010, Dismas did not receive any inputs from MVP and did not apply for the Equity loan. Instead, he purchased 30 kilograms of DAP, 25 kilograms of urea

[119] As part of the input subsidy programme, MVP required each farmer that received the input package to repay 10 percent of their yields to the MVP school meals programme.

and six kilograms of Monsanto maize seed. Unfortunately, that year his yield was exceptionally low. He attributes this to the monkeys, squirrels, hailstorms and *Striga* that continue to affect his fields. Yet, he shrugs this off saying these challenges are a part of farming and adds that things are better now that he uses fertilisers. Dismas says he will continue to depend on his masonry work for income but that he has changed the way he farms since he experimented with fertilisers. He had always known about fertiliser but thought it was too expensive. He now ranks fertiliser as a priority and has started saving his money for the following season's inputs.

The third group (12 percent of all households) consists of farmers that had not used improved inputs prior to the programme and who are now continuing to purchase inputs but at low rates. These farmers have adapted the input package in some fashion to fit their current situation. They rely heavily on the composting and *boma* manure techniques they used prior to the project, but have added small quantities of inorganic fertiliser to the mix. The purchasing of inputs is also rather variable, rising and falling depending on their financial status. Interestingly, these households are split evenly between the highest and middle-income category, suggesting other external factors must come into play when purchasing inputs. The one similar trait that this group has in common is that they are all older (55+ years old) female-headed households.

For example, Sara is an elderly (82-year-old) widow from Lihanda. She describes how she had changed her beliefs about fertiliser after the programme. She benefited from having one of her plots as a demonstration site by MVP and describes her experience positively:

> *I started using [inorganic] fertiliser with Millennium. In earlier days, these farms were more fertile. There was no knowledge of fertiliser, but maybe manure from the chickens, we were using that method. However, if you use fertiliser there is a very high yield. If you try a portion with fertiliser and one without, there is a very big difference. When we tried to plant one portion with and one without we realised the difference and now I will always try to plant with fertiliser.*[120]

[120] Series of interviews with an elderly female farmer from the wealth category B, Lihanda, Siaya, May 2009 – June 2010

Yet Sara's change in perception about fertiliser does not always translate to change in ability to purchase improved inputs. She admits that when the subsidy ended, she managed to purchase 3–5 kilograms of fertiliser, which she uses on a very small rocky plot next to her house. However, even this small amount is more than she was purchasing before. In addition, she has been able to rent more land. Working with her son, they have expanded their farm and leased some better quality land. The previous year she rented a quarter acre, and this year she has rented almost a half an acre. She focuses on putting the little fertiliser she can purchase on her own home field because, as she says, the new rented land is "still a bit fertile".

Sara explains that pests (e.g., *Striga,* monkeys, moles and squirrels) and natural calamities (droughts and hailstorms) affect her yields on a yearly basis. She believes that increasing the land area will help to spread the risk. Sara counts herself lucky that she has two grown sons who live with her and work the land with her. Therefore, she feels that labour is not her biggest issue; it is more the unknown of what might happen once she starts planting. The perceived risks have made her cautious about spending too much on inputs, only to have her yields affected by pests, diseases or the weather.

These findings are reinforced by Okoth's report on adoption rates in MVP, which also emphasises the importance of household demographics as a determinant to adoption. Okoth found that household demographics, including age and gender of household members were "directly linked to adoption of any interventions" (Okoth, 2010:68). The report goes on to show how the age of household members is a good indicator of the labour available and that households with productive members could offer the most labour towards producing enough food for the household (Okoth, 2010: 68).

The last group (20 percent) represents the households that have decided not to purchase the inputs after the subsidy disappeared. This group was predominantly (86 percent) female-headed households. This demonstrates that the poor and vulnerable were at times unable to adopt the technology in the ways assumed by the project. Rael's story is typical of the constraints faced by poorer farming households in the area.

Rael is a young widow and mother of four young children. Her husband died eight years ago when Rael was just 21 years old. In accordance with Luo tradition, Rael was

remarried to a relative of her late husband as his second wife, with whom she has had her last two children. However, Rael continues to live alone in her compound with her children and farms her land on her own. Labour is a constant issue for Rael. Her deteriorating health has made it increasingly difficult to keep up with the demands of farming. She describes the mixed blessing that she saw with the new technology she started using when MVP started in this area. She mentioned the increase of weeds and the effect this has had on her labour demands:

> *I have mixed feelings about fertilisers. It is sometimes good or bad. If you do not use fertiliser well in the field it triggers weeds to come up strongly. It forces me to do early weeding; if you leave the weeds, it will grow taller than the crop. Another problem I see with fertiliser like DAP is when the crop is this tall [chair height] it needs another fertiliser, like urea. You have to use urea for top dressing. Otherwise, the crop is not as good. And that is an added cost that I cannot bear.*[121]

Rael benefited for two years (2006/07) from MVP's subsidised input programme. However in 2008, when the loans programme started, she decided against applying as she feared she would not be able to pay back the loan. She was told that repayment was six bags of maize. Yet, the largest yield she has managed to get from her 0.30 hectare was six bags, even with the subsidised inputs. So based on her experience of past harvests, she did not know how she could repay the loan and have enough to feed her family. Therefore, she did not take the loan nor did she purchase any inputs. That year, her situation, along with her health, continued to deteriorate. In 2009, she was put on the vulnerable list and received 25 kilograms of DAP, 25 kilograms of urea and four kilograms of maize seed. She planted on 0.2 hectares of her land and managed to harvest three bags of maize.

The following year (2010), Rael had been certain her name would be on the list again and she only found out in March when she went to pick up the inputs that she was not part of the vulnerable programme. She does not know why she was not on the list. Her neighbours told her that it depends on luck, and she might be back on the list next year. Rael says that since she had not properly planned or saved money for the inputs, she was not able to purchase any for her farm. Therefore, she planted with local seed and

[121] Series of interviews with female farmer from poorest wealth category C, Lihanda, Siaya, May 2009 – June 2010.

some goat manure. Rael admits she has never gone to purchase fertiliser, however she has recently joined a women's savings group and hopes to save enough by the end of the year to purchase inputs for the following long rains.

For the past two years, Rael has suffered from deteriorating health. Her poor health, poverty, limited access to land, labour and finances, and her marginal social position in the community has made it difficult for her to adopt or adapt the new seed and fertiliser technologies to fit her specific requirements. While some farmers have been able to take advantage of the technologies, Rael has been unable to benefit. She does mention the training she received and the importance of fertilisers, however she is unable to plan properly and save to purchase the inputs. The programme must have a clearer understanding of the constraints that Rael faces and a deeper understanding of the types of technologies she may require to assist her out of poverty. In this instance, a predetermined package of inputs for a set period was not the right set of interventions required for her current situation. A more nuanced approach that examines her constraints and her options may have come up with a more flexible plan.

These stories offer a small glimpse into the realities of the farming households in Siaya served by the MVP and associated initiatives. The sample size is too small to make generalisations on the characteristics of adoption or dis-adoption, and this was not the underlying rationale for the research. However, by taking a socio-technical systems approach, the research shows how the patterns of social differentiation and social structure dramatically influence the nature of adoption and technological access. The characterisations of these groups show the varied responses to a given technology. Much depends on a household's demographic composition and socio-economic characteristics, such as wealth, age, gender, or health status, particularly of its main producers, or its vulnerability to internal and external shocks (i.e., death in the family, droughts, disease, etc.), which can affect a household's financial situation.

All households are susceptible to shocks and stresses of different kinds. Some have developed better coping mechanisms for responding to risk and uncertainty. Each household reacts differently to these disruptions, depending on their individual circumstances. Some farmers have altered their use of new technologies and have developed new practices in which they are able to create a niche and become less

passive recipients of the knowledge offered by the project. Other farmers have been unable to interact with the technologies in this way and have been locked out of any benefits the inputs may offer. By using a case study approach and investigating the background to their decision-making processes, the unique and varied nature of these complex farming households becomes more evident.

Conclusion

This chapter describes how MVP has undergone a number of modifications and administrative 'retooling' over the years as it has developed. Originally a broad Green Revolution narrative focusing on technology interventions to address food insecurity, MVP has experienced interaction at the national, programmatic and local levels, during which key actors have renegotiated the MVP concept. This co-evolution of technology and society results from changing politics in the relationship between headquarters and the field and the tensions that exist between framing, funding, implementation and practice. Some of the changes have been made in response to challenges arising in the field, where ideas and practice interact with the realities of the local socio-technical system. Others were in response to macro-level factors resulting from the broader political, economic and institutional context, with ideas originating from the New York headquarters being implemented by field staff who may not necessarily agree with them. Some changes were influenced by the need to show results quickly, perhaps faster than field staff and villagers could adapt. Therefore, the programme is not static and continues to be transformed throughout time.

As described in the chapter, the input model was modified at least four times over the course of five years (2005–2010) to include the following:

- *Direct distribution:* inputs distributed directly from MVP to recipients through designated collection centres on specific distribution days
- *Agro-dealers and vouchers system:* MVP trained 18 local agro-dealers within the sub-locations and offered vouchers that were redeemed at these shops
- *Private company:* MVP created Millennium Farms to manage distribution of inputs and worked with a micro-finance institution to offer loans, with repayment in maize to Millennium Farms

- *Commercial bank loans:* MVP created a partnership with a commercial bank to offer loans for a limited number of qualified households.

While the ability of the programme to make rapid changes and learn from its previous experiences shows flexibility and adaptability in its approach, the effects of a fast-changing mandate on local farmers need to be understood better. The shifting mandate of the input-support programme affected the relationships between the networks of actors in the community and within the project. It restructured the socio-technical system in fundamental ways. New actors were created, trust relationships were tested and there were changes in the power relations that determined access and delivery of the new technologies. The chapter also highlights the challenges faced by the programme in response to the changing national landscape, and in particular the political disruption that followed the 2007 elections.

The analysis also showed how local actors altered the technology package through gradual experimentation and learning to create their own unique niches, as well as in response to local administration, politics, social networks and delivery mechanisms. Farmers constantly re-adjusted their farming practices to create innovative niches in response to the changing system imposed on them by MVP, but also in relation to the dynamic and uncertain economic and ecological conditions they faced. Many new socio-technical arrangements emerged when the subsidy was removed. While farmers may not have adopted fertiliser at the promoted rates, their knowledge of the technology has changed fundamentally. They have had time to experiment with different seed-fertiliser-farm management combinations and have adapted them to fit their specific socio-economic contexts and priorities. New social arrangements around the technology have emerged that may not have been the intended goals of the programme, but have nonetheless had a positive impact on the farmers and their agricultural systems.

This analysis has shown that adoption and continued use of a new technology is heavily influenced by a multitude of factors that are external to the technology and depend on the delivery mechanism and messaging used to introduce that technology to a community of diverse users. Furthermore, the recipients' responses are determined by

their own socio-technical conditions and constraints. Thus, the early expectations of a 'quick win' focused on disseminating technology were hampered. The research thus highlights the link between socio-technical system change and social differentiation, with systems constructed and altered based on the different social, political and economic characteristics of the people on the ground. A much wider socio-technical system, differentiated according to wealth and gender, had to be transformed as well, in a fast-changing and challenging context.

This chapter demonstrates the differences in responses between the relatively asset-poor and those with better access to assets. It confirms how any new intervention presents a risk. This can be a social risk, when farmers are socially excluded from benefiting from certain technologies or access to information. It can be a financial risk, especially when credit is tied to the use of the new technology and when farmers divert limited capital to it, leaving little to cover other household needs, such as health care and education. In addition, it can be an economic risk, when access to the technology is tied to training and participation that may contain an opportunity cost for those who already suffer from labour constraints on the farm.

The next chapter takes a closer look at the second case study, the NAAIAP, to highlight some of the similarities and differences between the programmes' design and the interaction of the technology package within the existing local system. It thus sets up the comparative chapter (Chapter 8) that will draw some broad lessons from the two case studies.

Chapter 7

The National Accelerated Agricultural Input Access Programme: A large-scale national targeted subsidy programme

In 2007, the Government of Kenya launched the National Accelerated Agricultural Input Access Programme (NAAIAP) with the aim of addressing food security and poverty among resource-poor farmers. In line with the Government of Kenya's perspectives on national food security, described in Chapter 4, this programme is linked directly to the overarching policy objectives of increasing agricultural productivity and improving farm management among smallholders. The central aim of the programme is to reach 2.5 million smallholder farmers (those with one hectare of land or less) with a predetermined technology package comprising seed and fertiliser. Initially, the programme was funded entirely by the Government of Kenya. Since 2008, additional donors, including the Egyptian Government, European Union, Food and Agriculture Organisation (FAO) of the United Nations, Japan's International Cooperation Agency (JICA) and the World Bank, have contributed additional funding to expand the programme.

While increasing smallholder yields is the overarching rationale for the programme, the main strategy for NAAIAP centres on addressing low fertiliser usage rates. According to the programme documentation, less than 30 percent of smallholder farmers in Kenya's high-potential areas, and less than 20 percent in the low-potential areas, use inorganic fertiliser and improved seed (GOK, 2008b: 2). It states that many smallholder farmers in marginal areas do not have the knowledge or the financial capital to purchase the inputs. This low input usage has resulted in declining agricultural productivity, increasing food security and deepening poverty (GOK, 2008b). NAAIAP was designed to address the poverty trap by improving smallholder farmers' access to Green Revolution inputs, thereby increasing yields of the main staple crops, particularly maize, and enhancing household-level food security. This fits directly into

the productivity-technology fix narrative that views improving access to technology as the principal means to reduce food insecurity.

In addition, the programme expects the raised yields will allow farmers to generate additional income and be able to save, so they can purchase their own inputs the following year. The programme also seeks to strengthen the capacity of the value chain by supporting smallholder farmers, private agro-dealers and government extension officers through training on the effective use of improved inputs (GOK, 2009). NAAIAP aims to link the farmers to a network of agro-dealers who can provide inputs to local markets to ensure sustainability of the programme. It strives to improve access to credit for farmers and agro-dealers to help strengthen the entire value chain. The programme also trains farmers and extension officers in establishing and managing co-operative groups, cereal banks and warehouse receipt systems to address the market difficulties often encountered by smallholders (GOK, 2010e). Thus, in addition to the technology transfer focus, NAAIAP adopts a two-pronged approach that brings in a wider systems view, linking technology change to markets and wider support services.

NAAIAP consists of the following two programmes:

1. The Kilimo Plus Starter kits (grant programme). This is the main component of the NAAIAP programme. Kilimo Plus is a subsidy programme that targets resource-poor smallholder farmers with a package of improved inputs to cover 0.4 hectares.[122] The farmers receive three vouchers worth 7,000 Kenyan Shillings (Ksh) (approximately US$90), which covers the cost of seed, planting fertiliser and top-dressing. The main technological input is a package of 50 kilograms of basal planting fertiliser, 50 kilograms of top dressing fertiliser and 10 kilograms of maize seed. While the initial programme discussed the need to focus on a range of crops, during the roll out of the programme the focus has centred on maize. The programme expects that farmers will 'graduate' from the input grant onto the credit scheme described below.

[122] *Kilimo* is a Swahili word for 'agriculture'.

2. Kilimo Biashara[123] **packages (credit scheme).** This smaller programme is a credit scheme that targets farmers who are considered slightly better off than the Kilimo Plus target group, yet are still financially constrained and not able to purchase agricultural inputs. This group of farmers can apply for credit to purchase inputs from Equity Bank, at slightly subsidised interest rates.

While the NAAIAP programme has both components, my research focused exclusively on the Kilimo Plus, the targeted input-support programme. I excluded the Kilimo Biashara from the study as it was much less developed and targeted larger-scale commercially oriented farmers, and so went beyond the focus of this research. Therefore, the term NAAIAP will refer to only the Kilimo Plus (input-support) component of the programme. This element of NAAIAP is the main component of the government programme and has important similarities to MVP, although with a very different level of intensity in programme delivery (see Chapter 6).

Design features of NAAIAP

Initial discussions around NAAIAP began as early as 2003, when the government held a meeting with a number of international donors and partners involved in the agriculture sector in Kenya to discuss how to improve smallholders' access to seed and fertiliser. According to Steve Collins, Country Director of ACDI/VOCA, an NGO that manages a USAID-funded maize development project in Kenya:

> *The original idea was to get support to smallholder farmers with improved seed and fertiliser. This was the original point so that the farmers can actually have access to these inputs. We were not talking about subsidies, at this point we just wanted to make sure the input got out to smallholder farmers.*[124]

Following this meeting, the Rockefeller Foundation funded a concept document, which investigated input access problems and developed a programme to address them. The original concept focused largely on training and linking smallholder farmers to markets and credit lending institutions. The government and donors organised national-level consultations to bring multiple stakeholders – including private sector input providers –

[123] *Kilimo Biashara* is a Swahili phrase that is often translated as 'agricultural business or 'farming as a business'.
[124] Interview, Steve Collins, Country Director, ACDI/VOCA February 19, 2010, Nairobi.

to the table to discuss the specific challenges facing smallholder farmers. Rockefeller presented the final proposal to the Ministry of Agriculture. However, the government decided to increase the number of recipients significantly, introducing a much larger programme than had been envisaged in the concept work and aiming to provide subsidies to 2.5 million smallholder farmers over five years. There were many different views on why the government expanded the programme from the original proposal. One senior staff member from Rockefeller explained it as the disconnect that happens between policy and implementation:

> *That is the difference between policy design and implementation. Because in the design they were to concentrate in particular areas and work with a specific number of farmers and create that link with the credit programme, from Kilimo Plus to Biashara. However, Permanent Secretary Kiome [Ministry of Agriculture] wanted it spread out from the beginning, maybe because of political pressure. Therefore, it ends up too thin on the ground and the end results would have been better if they had not done that.*[125]

The government was keen to push the low productivity trap narrative and demanded a nation-wide response programme for a number of reasons. First, the recent success of the Malawi subsidy programme (AISP) had created high awareness, and many African countries, including Kenya, were looking to create a similar model. Festus Murithi, Director of KARI, explained it in these terms:

> *The subsidy programme in Malawi can be good for a government as it saves the government the embarrassment of having to beg for food. There is nothing as bad as when someone uses food to make you take certain decisions because if you get it wrong you are going to die of hunger. Malawi did whatever it takes. The president said, "My people should be fed, and other things can come later". When people are food secure they can look for off-farm incomes and this can be channelled to education and other social things that the farmer requires. However, food, whether you are rich or poor, takes a substantial part of the budget. I think it is a social responsibility for any government to ensure people are food secure.*[126]

Second, the political make-up of Kenya, with a mix of different ethnic groups and power networks, and the tense political environment leading up to the 2007 national elections, forced the government to consider a wider focus for such a politically

[125] Interview, Rockefeller Foundation, February 15, 2010, Nairobi.
[126] Interview, Festus Murithi, Director, KARI, Nairobi, March 16, 2010.

sensitive national food security programme that had the potential to affect large numbers of people across the nation. Therefore, as mentioned in the previous chapter, political interests can capture such programmes and affect the ultimate design and implementation. As Steve Collins from ACDI/VOCA explained:

> *NAAIAP is trying to be everything to everyone because of the politics in Kenya. You cannot give the inputs specifically in one location, which was the original plan - to concentrate in one area. However, the government said, "No, it has to go to every single person". This was whether it was suitable or not. For example, the government promotes the programme in places like Ukambani, where you should not even be planting maize because four out of five years you do not get a crop, but there are political reasons why they go to those places. However, to me, this is politics and not smart policy.*[127]

The difference in geographical scope between a wide national programme and a narrow pilot within specific localities created a philosophical divide between the donor community and the Government of Kenya. The donors disliked the expanded subsidy programme and reduced focus on extension and training. They complained that the programme was spreading itself too thinly, spending too much of the budget on the subsidies, and focusing insufficient attention on training aspects. However, the government stated that the current food crisis justified this wider and faster approach, and that politically there were reasons of 'equity' for pushing for a broader and more inclusive food security programme. In the end, the government pushed ahead on its own. However, after one year of implementation (2008), a few donors came on board to help fund different parts of the programme. The following section goes into further detail on the administrative factors that have influenced the delivery of the programme and shaped its interactions with recipients at the community level.

Administrative factors: NAAIAP's capacity constraints

The government began implementing NAAIAP in 2007/08. In the first year, it funded the programme out of its national agricultural budget and was able to deliver inputs to 37 districts in six provinces, reaching 36,000 farmers. In the second year (2008/09), the programme received funding from the donor community and the focus area doubled to 70 districts. The programme reached roughly 96,000 farmers with agricultural input

[127] Interview, Steve Collins, Country Director, ACDI/VOCA February 19, 2010, Nairobi.

packages. By the third year (2009/10), further donor support allowed the programme to cover over 100 districts and to reach over 187,000 farmers. Farmers could only receive the input package once. This condition meant that the programme had to shift around the country and each year new sub-locations and new sets of farmers were targeted.

This rapid expansion and constant shift in project area made it difficult for the administration and delivery staff to implement the programme adequately. With such massive numbers of farmer-recipients in so many new districts, the amount of time needed to train the programme staff properly was severely compromised. In addition, the programme encountered problems identifying and training new agro-dealers in the new districts within the short timeframe. There were also problems with the programme logistics in terms of sourcing the right type of inputs in the right quantity and delivering them to the farmers in time for planting.

According to Dixon Korir, the Input Promotion Officer at NAAIAP:

> *We had a big jump in the number of beneficiaries this year because the EU came in. I think the figure was 187,000 farmers, almost double from last year, so there was a lot of straining. We strained the capacity of the stockists in so many places and there were serious problems in supplies especially in Eastern District. The same happened in the western part of Kenya where there were demands that we could not supply.*[128]

The increased donor support occurred for a number of reasons. Some donors decided that the political upheaval following the December 2007 elections warranted increased attention on food security. Some donors committed to funding in the areas hit hardest by the violence and tied their financing directly to delivery of inputs to internally displaced persons. These donors saw the programme as a form of relief funding and limited it to one year of support from their humanitarian portfolio. Other donors realised that the NAAIAP programme was going to happen with or without their involvement and decided it was better to be involved and to have a say in its progress. As Andrew Karanja, from the World Bank in Nairobi, put it:

> *I think the same thing played out as it did in Malawi. There are always misunderstandings when a programme starts. What was not clear initially was*

[128] Interview, Dixon Korir, Input Promotion Officer, NAAIAP, Nairobi, August 20, 2010.

> *how the subsidy was going to be implemented and then it became clear to us that it can be implemented through the agro-dealers and private sector, and we do not have to give it directly to the farmers. Because we initially thought it was a package that we just go and dish out to farmers. The other thing we realised is that if we stay out of it we will never be able to correct some of the issues. When you are inside it is easier to say this is working, this is not working. You are better off criticising from within rather than from outside because they harden their position and you harden your position.*[129]

NAAIAP programme staff had their own set of institutional and administrative difficulties in implementing the national programme. There was no increase in resources and administrative staff had to rely on extension officers already in the field to implement the programme. Despite having additional donor money for training field staff and related activities, there was little evidence of that training in many of the areas where it was implemented. NAAIAP staff mentioned the capacity issue as one of their main constraints:

> *The challenge was we had budgeted for 36,000 farmers in nine districts but now we have 175,000. We got support from the World Bank but to date not a single shilling has arrived. We are doing so much above the budget. We are overstretched. We have put in everything, our allowances, everything. We overstretch not just resources but also people. The DAOs practically close down their offices when NAAIAP comes.*[130]

The government's desire to scale up the programme rapidly exacerbated the capacity and logistical problems associated with delivering the right inputs in the right quantities to farmers at the right time. All these factors affected the ultimate delivery of the programme and its interaction with the smallholder farmers. The next section explores how issues of administrative and institutional capacity affected NAAIAP's implementation and ultimately the beneficiaries' understanding of the programme. It examines how institutional factors interacted with the existing political and socio-cultural factors of the farmers in the given locality.

[129] Interview, Andrew Karanja, Agricultural Economist, the World Bank, March 16, 2010.
[130] Interview, NAAIAP Officer, Nairobi, April 13, 2010.

Unpacking the socio-technical system: Interactions between farmers and NAAIAP in Butere District

While the first section focused on the institutional evolution of the programme, particularly *Kilimo Plus*, this section analyses the interactions between the farmers and NAAIAP's organisation. In so doing, it examines how the programme interacted with the social, cultural and institutional structures of the farming households and communities in the target areas. The section is based on a series of semi-structured interviews and focus groups in Butere District in Western Kenya (see Chapter 2 for methodology) and explores how NAAIAP's tightly controlled selection and distribution channels did not allow for information sharing or proper training of programme recipients, and created misconceptions and distrust between recipients and administrators. It details how NAAIAP's processes and administrative structures affected the farmers' perceptions of the technology package and their view of the overall success or failure of the process.

By unpacking the different political factors and knowledge–power relationships at the community level, this section highlights how complex social processes interact with technology packages in a very site-specific way. Echoing the experiences in MVP, it analyses how the programme used the existing administrative structures in the community to ingrain existing power structures, which benefited some privileged farmers and interest groups over other less well-connected producers. It also examines how and why different farmers were able to adopt, adapt or reject the package in such a way as to allow innovation niches to develop that resulted in different kinds of transformations and changes to the local socio-technical system.

The politics of selection and distribution channels

When introducing a programme that includes the delivery of a technology, the initial contact made with communities establishes perceptions and awareness about the technology that often affects successful adoption and uptake. NAAIAP's messaging process in Butere began with the area Assistant Chiefs and programme administrators briefing the village elders. The programme administrators briefed the village elders on

the selection criteria and asked them to identify eight 'serious' farmers in their village who should benefit from the programme. The criteria they were told to use were: i) must have one acre of land that they are farming; ii) must have used fertiliser before; iii) must be able to store produce; and (iv) must own their land. The nature of the selection criteria resulted in the exclusion of many low-income households from the process.

The elders gave the names to the locally hired Agriculture Representative (known locally as 'farmer reps'). The farmer reps are local farmers enlisted by the government to help the extension officers implement NAAIAP and other programmes. Their role is to help the extension officer to facilitate the programmes and to liaise between the farmers, the village elders and the government officials. The positions are held for two years and are unpaid, although they receive a stipend for each day they assist the extension officer. They receive additional training and are viewed as front-line extension workers, which is an added benefit to participating in the programme. The farmer reps tended to be relatively well off and well connected, both socially and politically, to the village elders and the area chiefs.[131]

The farmer reps visited each household and confirmed participation in the programme. An extension officer from the Ministry of Agriculture accompanied them on these household visits to verify the status of the recipients and to conduct a questionnaire for later use as a monitoring tool. However, these questionnaires were conducted in only half the cases. In most cases, the farmers had very little contact with the extension officer. Contact with the farmers was left entirely to the farmer reps and the village elders. This ensured continuity of the power relationship between the village leaders and the community, and did not allow the community to question the implementation of the programme. Once the farmers were confirmed, the list was submitted to the Assistant Chief, who gave his 'stamp of approval' and forwarded the list to the Divisional office in Khwisero.

Since the village elders and farmer reps compiled the lists, there was very little community involvement in the selection process. In addition, little information about

[131] While the community elects the village elders, the chiefs are political positions selected by the government to act as their representative at the local levels.

the programme in general filtered down to the community. Even the Ministry of Agriculture's information sessions (referred to as sensitisation and mobilisation activities) tended to focus on senior field officers and village leaders. Community members had few opportunities to learn about the programme, to develop support or to spread the message. Of the 13 village elders interviewed in this research, only two reported holding community meetings to read aloud the recipient's names. Yet, even these two elders admitted that meetings were intended to present the recipient list, not discuss who should or should not be included. As one village elder and a beneficiary of the programme stated:

> *The problem is everyone will say they are food insecure in the villages and I had to choose only eight households out of 230. The task was too difficult and it could lead to a lot of quarrels in the village. Therefore, I called a baraza where I read out the names. I first explained the criteria given by the government so they would understand why some people were not on the list and I told them that only eight people could benefit. Therefore, no one could complain if they did not get the inputs when they heard those criteria. That helped me and I did not have a hard time.*[132]

The fact that he was a village elder as well as a beneficiary of the programme demonstrates how power networks in the community exerted pressures on the NAAIAP selection process. Access to the technology was biased heavily towards those who were linked to the patronage networks of the local chief and extension officer. Very few community-wide information sessions were held to explain the programme or its mandates. Therefore, very little information passed beyond those in the programme, leaving many non-recipients with little knowledge or understanding of the programme.

The lack of wider community sensitisation and involvement led to misunderstandings and personal conflicts within the communities. In addition, the lack of information allowed those with access to the process to benefit disproportionately. Therefore, changes in social dynamics occurred as some groups benefited more than others due to their access to particular patronage networks and ethnic and economic interests, resulting in shifts in the socio-technical system within the community. The next section takes a closer look at how the programme and its technology package interacted with the pre-existing social and power relations at the local level.

[132] Interview, Village Elder, Emutsasa, Butere, May 20, 2010.

Social dynamics and power relations: factors affecting targeting and selection

As described above, the delivery of NAAIAP's agricultural input package is based on a targeted subsidy directed to subsistence farmers throughout the country. The constraints, both political and financial, meant the programme had to cover many areas to address the various ethnic groups within the country. However, available financial capacity limited the number of farmers who could be included. The result was an input-support programme that spread benefits to approximately 1,000 farmers within each of the 37 districts in which NAAIAP operated. This equated to an average of eight out of 200 households in each village.

Targeting the poor in any input-support programme is considered difficult because it is hard to identify appropriate beneficiaries and there are concerns over 'elite capture' by certain social networks within the community (Levy et al., 2004; Bahiigwa et al., 2005; Chinsinga, 2005; Crawford et al., 2006; Minot and Benson, 2009). One of the major issues with targeting food security programming is that the "ambiguity of targeting leaves open the possibility that outcomes will reflect local power structures rather than the priorities of the poor" (Bahiigwa et al., 2005: 494). This ambiguity of targeting was displayed by the lack of communication with the community about the subsidy programme or its objectives prior to the list of recipients being announced. Members in the community had little knowledge of how the recipient list was put together or what targeting procedures were used. Even those that benefited from the programme had little understanding about who was accepted and why:

> *All I know is that my name was on a list. I do not know much about NAAIAP.*[133]

> *The village elder, who is my brother-in-law, came to tell me that I was wanted at the Chief's Baraza [community meeting]. That is how I found out that I was to benefit from the programme.*[134]

> *I do not know how I was picked for the programme, but I heard about it at the market that I was on the list of beneficiaries.*[135]

[133] Interview, male farmer, wealth category C, Khushiku, Butere, June 15, 2009.
[134] Interview, female farmer, wealth category C, Khushiku, Butere, June 18, 2009.
[135] Interview, male farmer, wealth category A, Doho, Butere, June 23, 2009.

One farmer rep in the area explained that little information was shared about the programme prior to its start in Butere. According to him, this lack of information caused misunderstandings and some farmers expressed initial mistrust about the programme. Farmers feared that their lands might be confiscated because they were asked to provide their land titles to become registered with the programme. He went on to state:

> *Some farmers actually declined to be included in the programme from fears about their lands being affected or other consequences of an association with NAAIAP fuelled by misinformation.*[136]

A farmer in Emutsasa explained his fears in this way:

> *The farmer rep came to my house and told me about the programme. He said I needed assistance and the government was coming with a programme for us. I was hesitant to accept because I thought it might create problems, since nothing in life is free. I worried about losing my land or that the rep was trying to trick me. However, after much discussion I decided to accept and gave my name for the list. I was asked for information on my land title deed, which I gave them.*[137]

To be included was seen by many as a privilege and as an indication that they were good and 'serious' farmers. However, some were not happy to be included. Through my research, I found that the selection and targeting process caused tensions in the community with those not selected. One poorer widow reported that by including her in the list, she was targeted by other widows in her community who were not selected. She complained that even though her status as head of a poor vulnerable household would make her a prime candidate for the programme, it created feelings of jealousy towards her that made her life harder in the village. She went on to state:

> *In my view, the government should have supported everyone in the area and not just the people they were selecting. I feel that it is not good when one person benefits and a neighbour does not benefit. It brings some problems. So many people, even my neighbours, complained when I benefited.*[138]

[136] Interview, farmer rep, Emutsasa, Butere, July 6, 2009.
[137] Interview, male farmer, wealth category C, Emutsasa, Butere, May 18, 2010.
[138] Interview, female farmer, wealth category C, Khushiku, Butere, May 21, 2010.

In one focus group meeting, village elders explained how farmers voiced concern that community members had influenced the selection and that the process had not been transparent.[139] There were instances of well-off farmers using their position of power in the village to ensure their names were on the list. For example, one well-off farmer described how he became part of the programme, this way:

> *This was a favour from the chief. Initially my name was not on the list so I went to talk to the chief and then found my name had been added to the list.*[140]

In this instance, the farmer's entitlements are expressed in political terms. He was able to use his influence with the political structures to affect the way the goods were distributed. Therefore, not only was the list influenced by the social standings and power relations within the villages, at times the political administrative structures at the district level also had an influence. One village elder from Doho explained how he felt that names had been added to the official list after selection had been finalised at the village level.

> *I forwarded the final recipient list to the Agriculture Extension Officer, who noted the list included 83 farmer recipients. However, at the distribution centre, more than 100 farmers were found on the list. The additional names resulted in an input shortfall that meant many recipients had to split the package of inputs between two households. The increased number of recipients had not been communicated to the farmers or the village elders, and those who had to share were greatly disappointed and felt cheated by the programme. This left a very negative impression on those farmers and village elders who had made the community selection. There was no explanation from programme officials about how or why names had been added to the list.*[141]

This lack of communication from the programme staff to the community created many points of contention and confusion throughout the life cycle of the programme and affected how the community interacted with the programme. These feelings of mistrust extended to some of the farmer recipients as well. For example, one farmer reported that programme staff administering the inputs misappropriated the inventory:

> *I think there was a deal between the agricultural officers and the extension officers because I am told the extension officer's own family got about five bags*

[139] Focus group discussion, Doho, Butere, June 2009.
[140] Interview, male farmer, wealth category A, Khushiku, Butere, May 20, 2010.
[141] Interview, village elder, focus group discussion, Doho, Butere, June 2009.

> *of DAP, his wife got, his daughter got. So that denied most farmers here to get the inputs. Imagine, his own household received five bags when some of us got half a bag.*[142]

Whether these facts of elite capture or misappropriation were real or perceived by the community members, it illustrates the feelings of mistrust between the community and those administering the programme that ran through most discussions. There was little interest in seeking assistance from the programme officials because of a general feeling that programme staff and the administration had engineered additional benefits for some in the community. These feelings extended to the local administration units. As one farmer from Emutsasa reported:

> *The mistake the government is making is by involving the administration and bringing the Assistant Chiefs into this, and they are corrupt. If you involve the Assistant Chiefs they may decide they are not on good terms with someone and do something to the selection process.*[143]

These irregularities demonstrate how people in positions of political or social power can use their influence to affect project outcomes if effective verification processes are not in place. While difficult to determine whether this problem occurred throughout the process, it demonstrates there were ample opportunities for such transgressions to occur.

The ambiguities in targeting had a direct effect on who was able to participate in the programme. One early observation about programme recipients in Butere was that they were either on a par with, or in some cases better off than, the average households in the targeted sub-locations. The chiefs and farmer reps confirmed that they had selected 'serious farmers' for NAAIAP and excluded farmers they felt were too poor or might misuse or sell the inputs. A farmer rep said that there was pressure from NAAIAP programme staff and area chiefs to ensure the programme succeeded. He stated:

> *We were told from the District level [DAO office] to choose those farmers that we believed would not sell the inputs and would put them to good use... we were told that we need the programme to succeed so it can continue.*[144]

[142] Interview, male farmer, wealth category A, Doho, Butere, May 14, 2010.
[143] Interview, male farmer, wealth category C, Emutsasa, Butere, May 19, 2010.
[144] Interview, farmer rep, Kisa West, Butere, May 13, 2010.

The result was a shift in focus away from the initial concept to include food-insecure smallholder farmers and towards 'serious' farmers who were often associated with local elites and government officials. The objective and implementation of the programme was altered at the district and sub-district level and further shaped by extension officers and village leaders who wanted to ensure the success of the programme and their own personal agendas.

These findings are in line with research into the problems of targeting raised in the Malawi subsidy programme (cf. Levy et al., 2004; Minde et al., 2008; Minot and Benson, 2009). These studies found that targeting the poorest is often difficult as it can cause "major social resentment and disproportionately reducing food security gains" (Levy et al., 2004: 1). Administratively, the costs of targeting smallholder farmers can be extremely high (Minot and Benson, 2009). In addition, setting criteria to ensure success (such as larger land holding or wealthier households to ensure more efficient use of the inputs) can at times provide subsidised inputs to relatively well-off farmers and exclude the very groups the subsidy was intended to assist (Minde et al., 2008). Therefore, the results of poor targeting procedures and administrative capacity resulted in inputs being appropriated by wealthier farmers and not being directed to the appropriate beneficiaries. This was inconsistent with the national policy objectives set out in NAAIAP to address poverty alleviation and food insecurity.

Capacity building and participation

One key determinant for success when introducing a new technology is establishing awareness about the technology and its potential benefits, risks and use. Dissemination of the information is important, not only to increase adoption, but also to "strengthen human and social capital such that farmers can continue the dissemination process inside the village" (Place et al., 2005: 28). Success depends on recipients having an appropriate understanding of the technology, in terms of its application, usage and benefits. A poorly administered dissemination approach can have long-lasting negative effects on the community and has "as much impact on adoption as the nature of the technology itself" (Place et al., 2005: 28). Knowledge about inputs and appropriate training is a likely indicator of successful adoption (Kelly et al., 2003: 383). Likewise, a

study by Mango (1999: 20) found that farmers' use of a particular technology was tied closely to their knowledge of how to use it appropriately:

> *Farmers' inefficient use of fertilisers was another reason why they abandoned it. The benefits of fertiliser will be limited when farmers use the wrong type, apply too low rates, or use it at the wrong moment.*

Training beneficiaries on planting techniques, fertiliser use, post-harvest management and forming groups for cereal banks were key components for NAAIAP.[145] Local administrators promised farmers that they would receive training as part of their input package and this raised expectations. Administrators told the farmers that training would be conducted on demonstration plots throughout the villages. However, very little training took place in the research area and very few planned field demonstrations were implemented due to a lack of extension officers to carry them out. Instead, recipients were assembled at a *baraza* and briefed about the programme and how to use fertiliser. These briefing sessions did not measure up to the farmers' expectations for training. The limited information they received affected their understanding of the rationale of the programme, leading to confusion concerning its objectives and intended benefits, further adding to farmers' frustrations. One wealthy female farmer from Khushiku explained:

> *We received some information on planting, using fertiliser and top-dressing and how to dry the maize. However, I would not call it training since we did not learn anything new and we did not go to the farm as we were promised. In that way, the programme let us down.*[146]

In addition, the training intended to introduce new techniques (e.g., spacing, application of fertiliser and other crop management techniques) but this message was not delivered in a way that matched the needs of the respondents. The information package was not adjusted to fit with existing knowledge nor was it modified to fit local needs. Out of the 36 NAAIAP households interviewed, only 11 percent of respondents (split between

[145] Cereal banks are village cooperatives that bring farmers together to buy grains at harvest time, store the grain, and then seek better selling prices for members later in the season. This idea was promoted by NAAIAP (as well as MVP) as a way to smooth the price fluctuations that occur during the season. The expectation was that these cereal banks would offer a way out of the subsidy, since farmers could generate the required income to purchase inputs the following year without the subsidy.
[146] Interview, female farmer, wealth category A, Khushiku, Butere, May 10, 2010.

wealth categories A and B) reported that they had sufficient awareness about the fertiliser package and did not need further briefings:

> *We were not trained at the meeting since everyone there already used fertilisers, we were told to go and plant as we normally do. Therefore, we did not need the training.*[147]

Overall, the single briefing session and lack of follow-up training did not disseminate the technical messages that NAAIAP intended to pass to farmers. Recipients in the three sub-locations I studied reported that they gained only minimal knowledge and understanding of the technology and programme through NAAIAP training. There is little structure within the programme to engage with the community and determine their information needs. In addition, despite having a comprehensive list of capacity building items in the NAAIAP programme document, only general discussions about the need for fertiliser actually took place. According to those farmers I interviewed, this was of minimal value to most recipients who were already experienced with the technology.[148]

Changing farmers' perceptions and prompting farmer-to-farmer learning requires provision of appropriate information, tailored to the local context and presented at the right time. In the case of NAAIAP, this did not occur so there was no substantive change in the local socio-technical system surrounding that technology. The lack of qualified trainers and community involvement prevented development of an appropriate curriculum. The political pressures to expand NAAIAP rapidly across the country led to over-hasty implementation without consideration of the importance of strong local involvement. This section demonstrates that NAAIAP did not consider the fact that technologies affect, and are an effect, of their broader environment. As stated previously, it is not about the intrinsic workings of a technology, but how it is embedded within a specific and dynamic socio-technical system that includes local knowledge and social structures and institutions. The disconnect between the national political and administrative capacities and the local realities affected the implementation of the technology package and its ability to create a positive, lasting

[147] Interview, female farmer, wealth category B, Doho, Butere, May 17, 2010.
[148] As mentioned in Chapter 2, the percentage of Butere farmers that were purchasing fertilisers was 91 percent, which is much higher in comparison to the MVP site, which was 39 percent. Therefore, according to my interviews, the NAAIAP training on general discussions of fertiliser usage was of less relevance to the farmers in Butere.

impact on local farming systems. The next section goes into further detail on the technologies that were part of the package and the programme's interactions with the community.

NAAIAP's input-support programme: Predetermined input selection

NAAIAP's input packages were targeted at maize production and contained 50 kilograms of planting fertiliser, 10 kilograms of maize seed and 50 kilograms of top-dressing fertiliser. According to the NAAIAP annual report (GOK, 2008b: 10) the programme distributed a range of basal fertilisers, including other nitrogen, phosphorus and potassium (NPK) ranges, DAP and single-superphosphate (SSP), and a range of top-dressing fertilisers including urea, calcium ammonium nitrate (CAN) and ammonium sulphate nitrate (ASN). DAP and CAN remain the principle basal and top-dressing fertilisers used in the input packages across the country.

One of the features of the NAAIAP programme in Butere was the inclusion of *Mavuno*, an inorganic planting fertiliser, in the input package.[149] The farmers in Butere were not familiar with this brand. Prior to NAAIAP, DAP was the most common planting fertiliser in this area. The purpose of this research is not to determine which planting fertiliser is best, but rather it is about an individual's perception of a familiar technology and the introduction and acceptance of a new technology. Therefore, this section takes a closer look at the politics determining the components of the input packages and how the farmers received them.

According to Esther Musyuka, NAAIAP Programme Officer, it was the field staff, extension officers and agro-dealers who decided what went into the packages:

> *The type of fertiliser was not set at head office. Local extension officers made the decision based on availability at local level. DAP is most liked by farmers and CAN, but there are many types of planting fertiliser out there and there is*

[149] Mavuno is a blended 10:26:10 NPK (nitrogen, phosphorus, potassium) fertilizer enriched with Calcium, Magnesium and Sulphur. Produced by Athi River Mining, a Kenyan cement company, Mavuno was first promoted for use with fruits and vegetables, but now is being marketed for maize, cereals, coffee, wheat, and tobacco. With its lower percentage of N and P to DAP (DAP is 18:46 NP) and with the addition of K, S, Ca, Mg, Mavuno is promoted as an input to combat soil acidity.

also urea. The type farmers get depends on what is available. The head office does not specify, we just say planting fertiliser and top dressing.[150]

Philip Makheti, the NAAIAP Director, defends the decision to provide *Mavuno* to recipients in Butere by explaining that excessive use of DAP has made the land acidic in Western Kenya. He goes on to state:

> *DAP was introduced in the area in 1976. By 1978, the soil pH was up. In addition, increasing population growth has forced more people into smaller pieces of land leading to excessive use of DAP, which has increased soil pH levels. Therefore, we need to return to basal fertilisers and I am an advocate for top dressing with CAN and liming. I known Mavuno may be seen as inferior but it has been passed by KEBS [Kenya Bureau of Standards]. What we need to do is to change the DAO's [District Agriculture Officer's] culture of DAP. Acidity must be reversed.*[151]

However, according to Dixon Korir, a NAAIAP Programme Officer, no proper soil analysis was undertaken prior to the programme to identify soil acidity or structure issues. The most recent national soil surveys were done in 1986 under FURP, which ran from 1985 to 1987. He explains:

> *Most of the farmers are using DAP but we are worried about acidity of soils. Therefore, I initiated a programme to test the soils. However, we used some people who just gave us the raw data and did not give us an analysis. That is the problem with going for the cheapest, they did not analyse. Now we have all this raw data but we do not know what to do with it, we cannot understand it. We took this data to the national labs but they refused to analyse it because they said it was not their samples. Therefore, we spent money on these tests and did not get results. So now, nobody knows the recommendations for farms in those areas. All the reports we are using are outdated.*[152]

Interviews with Athi River Mining, the company that makes the *Mavuno* fertiliser in this area, support the view that the soils are highly acidic. According to Julius Nyabicha, Technical Sales Manager, Athi River Mining:

> *The main problem in this country is soil acidity. Athi River Mining produces a lot of lime and we put it in our fertiliser so that instead of giving the farmers useless filler material we give them lime. DAP acidifies the soil, after a given time you are supposed to lime the soil but the Kenyan farmers never lime their*

[150] Interview, Esther Musyuka, Programmes Officer, NAAIAP, Nairobi, February 21st, 2011.
[151] Interview, Philip Makheti, NAAIAP Coordinator, Nairobi, January 27th, 2010.
[152] Interview, Dixon Korir, NAAIAP Programme Officer, Nairobi, April 13, 2010.

> *soils. So what is the remedy to that? It is to give them a fertiliser that does not acidify the soil and besides that, will be bringing the soil ph to the optimum level, which is 6.5, so that is our strategy. If you cannot help a farmer to buy a few tonnes of fertiliser to help lime the soil then include that lime in the fertiliser so that as the farmer uses the fertiliser they are also able to get that lime.*[153]

When the programme started in Butere, the NAAIAP officials and extension officers did not discuss the type of fertiliser to be included in the input package and no brand was identified on the voucher. The fertiliser voucher was generic and indicated a monetary value. However, farmers were offered no choice when they went to pick up the inputs at the agro-dealers. Many respondents mentioned that since the vouchers stated 'Planting Fertiliser' that there was an expectation that they could choose what they wanted. Instead, farmers were given a fertiliser that many felt was inappropriate for the area. In this instance, lack of information about the package coupled with a lack of choice negatively affected the farmer's perception of the programme and the technology package. The programme administrators' decisions on the fertiliser or seed variety were not discussed with the community prior to distribution.

Only five percent of farmers reported having used *Mavuno* previously. In all instances, these were wealthier farmers who had experimented with it on such other crops as vegetables. In contrast, all the farmers applying inorganic fertiliser to their maize crops used DAP and they were much more familiar and comfortable with this type of fertiliser. Therefore, recipients voiced their disappointment when they were unable to make a choice. They felt that they had little say in what they were given, reporting instead that it was the stockists who decided what to distribute. The seed component of the package was another issue. Farmers received little or no choice in the type of seed and the majority (83 percent) of farmers I interviewed said they preferred different seed types to those made available to them. This led to frustration and distrust between the farmers and the agro-dealers and programme administrators.

Many farmers voiced complaints about the inflexible, top-down approach, for example:

[153] Interview, Julius Nyabicha, Technical Sales Manager, Athi River Mining, Nairobi, April 14, 2010.

> *Who should be convinced on what is the best fertiliser for this area, the farmer or the manufacturer? Because these soils here vary a lot. I know much better about my soil than someone in Nairobi.*[154]

Another farmer questioned whether the programme had done field tests to determine the acidity of the soils in the area:

> *Mavuno has only a small component of DAP in it. It is purely lime so it is only good for acidic soils. It is not good for our soils. Most people in this area do not like Mavuno. They know only Chapa Meli and Mea [DAP].*[155]

A female farmer went further when describing her frustration with *Mavuno*:

> *The truth is Mavuno is not fertiliser, it is something else. Even when the vouchers came it indicated DAP, but when we went to the shops, we were given Mavuno. When we complained we were told that this thing is free so just take it.*[156]

One of the farmers who applied *Mavuno* later had to buy DAP for the rest of his plots. While admitting that the weather was bad, he observed that the fertiliser he received did not boost yields:

> *I had never used Mavuno before. The plot where I used Mavuno was worse. The plots where I used DAP were much better. I would not use Mavuno even if I got it for free.*[157]

Some farmers altered the fertiliser application and mixed the *Mavuno* with manure:

> *My perception is that Mavuno is not as strong as DAP, so I mixed it with cow manure.*[158]

Not all of the 36 farmers interviewed were negative towards *Mavuno*. One believes it is good when there is drought because it does not scorch the plants. Another farmer admitted that he could not judge whether *Mavuno* was good or bad since it was the first time he had used it and the weather was bad.

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[154] Interview, male farmer, wealth category A, Doho, Butere, May 14, 2010.
[155] Interview, male farmer, wealth category A, Khushiku, Butere, May 10, 2010.
[156] Interview, female farmer, wealth category A, Doho, Butere, May 17, 2010.
[157] Interview, male farmer, wealth category A, Doho, Butere, May 14, 2010.
[158] Interview, male farmer, wealth category A, Doho, Butere, May 17, 2010.

> *Last year was the first time to use Mavuno but there was a lot of drought that destroyed crops. If I could use it for three consecutive years then I would be able to tell.*[159]

All these quotes show a lack of satisfaction with the input package. A large percentage of the recipients (49 percent) purchased additional fertiliser (DAP). All the farmers interviewed added seeds, including hybrids and their own local varieties, to the variety given by the programme. The majority of this group (58 percent) were from the highest wealth category (A), while the remainder came from the middle wealth category (B). These farmers purchased additional DAP in the 10–50 kilograms range. In most instances, their purchases were in line with the amounts they typically purchased in the previous years. The programme had no great effect on the purchasing habits of this group, neither did it displace what they typically purchased. The majority of those in the lowest wealth category (83 percent) did not purchase additional fertiliser, but did mix the fertiliser with compost and *boma* manure. This group complemented the package with local seed or purchased small amounts of different hybrid seed to add to the quantities in the package.

Thus, farmers adapted the technology package to fit their own requirements. Some farmers purchased other seeds that they had used before and knew could grow well in their area. Other farmers continued to use their local seed and experimented with the government package seed in certain parts of their field. Others continued to purchase additional inputs or tested inputs in trial locations on their farms so that they could monitor how the inputs performed. These results show that farmers were re-adjusting their farming practices and opening up innovative niches to take advantage of the circumstance offered by the programme. These niches provided the farmers with new technology models that held better promise for sustainability and were more in line with their local economic situation than the original technology package.

[159] Interview, female farmer, wealth category B, Emutsasa, Butere, May 18, 2010.

Building the input-supply distribution network

NAAIAP's input packages were distributed through a voucher system redeemable through local agro-dealers. The government identified three agro-dealers in Khwisero to distribute inputs to the Butere recipients. Farmers collected their input vouchers for hybrid seed, planting fertiliser and top-dressing fertiliser from Khwisero Division Agriculture Headquarters. Each voucher had a pre-determined value. In 2009, the face value of the three vouchers was 7,000 Kenyan Shillings (approximately US$90).

Many recipients found it difficult to collect and redeem their vouchers. Khwisero is not within walking distance of any of the sub-locations so the farmers had to take public transport. This was especially difficult for the poorer households, especially women with young children. Monica, a widow from Doho, explains how the distance to the agro-dealers affected her participation in the programme. Monica is 35 years old and from the poorest wealth category. Monica lives alone in her compound with her three young children. She has half a hectare of land that includes the area where the house stands. There are no animals here, not even chickens. The home is bare inside and outside. Her food security situation is precarious. Monica's household consumption of maize is six or seven kilograms a week for her family and she estimates that her family consumes almost four bags of maize a year. However, her average yield when she plants without fertiliser is between one and two bags. This year she ran out of maize in March and has been purchasing maize since then. She will continue to purchase until harvest time in July. She does not sell her maize since she does not grow enough to support her family.

Figure 17: Monica Okinda and her family, Butere, June 2010

However, she cannot rely only on growing maize. She grows other crops, including beans, cassava, sorghum, sweet potatoes, banana, kale, cowpeas and avocados, which she uses to supplement her family's diet.

When the NAAIAP farmer rep came to see Monica at the beginning of 2009, she was unsure what the programme was about but was told that she would receive some farming inputs. She had no means to get to Khwisero to pick up the package so she decided to ask her neighbour Rebecca, also a young widow, to go into town to pick up the inputs and she would share the inputs with her. Monica explains:

> *The distance to get the inputs was very great for me. My neighbour Rebecca went to Khwisero to collect the inputs for me as my baby was still too young and I could not travel that distance.*[160]

Monica says the distance was an impediment for her and suggests future programmes need to have inputs brought closer to beneficiaries:

> *The government needs to have inputs brought closer to us as the distance to Khwisero is just too far for a widow like me, with small children, to travel.*

In addition to the remote location of the inputs, the fixed price of the vouchers was also problematic. The cost of inputs rose after the vouchers were printed. Approximately 29 percent of households complained that agro-dealers demanded extra cash on top of the voucher, arguing that the face value of the voucher was insufficient. As a result, farmers in some locations received smaller quantities. The government's annual reports also noted this problem, describing how agro-dealers, keen to maintain their profits, provided less seed or lower quality fertiliser in some areas (GOK, 2008b: 61). A few households alleged that the selected agro-dealers were artificially increasing fertiliser costs to reap higher profits. One farmer reported that agro-dealers were exchanging low-value inputs for vouchers and demanding cash in addition to vouchers for other high-value brands:

> *Mavuno is not good in this area. I feel that stockists gave DAP to others outside the programme because it is in high demand. So stockists were only giving Mavuno because it is cheaper and saving the more expensive and popular DAP*

[160] Series of interviews with Monica from wealth category C, Doho, Butere, May 2009 – June 2010.

> *for other people that are willing to pay for it. The problem is the voucher only had the quantity of DAP, so stockists gave cheap inputs to us in the programme, and then charged the government the higher amount on the voucher.*[161]

Another contentious issue for farmers was the late arrival of the inputs. The vouchers were delivered late to the Khwisero District Agriculture Office resulting in delays in distribution of the planting fertiliser and seeds. Further delays arose when the farmers were unable to collect the topdressing fertiliser (CAN) at the same time as the planting fertiliser and seed. This was due in part to the stockists having limited capital to stock all the inputs, as most were unable to stock all three inputs simultaneously. The majority were small local shops with little financial capital. One recipient, himself a shopkeeper, explained the plight of the stockist:

> *The stockist lacked enough capital to supply all the inputs at once. Now that the government payment is gradual, it could take up to three months for the stockists to get reimbursed so they are waiting for the first payment for the planting fertiliser and the seed before they can supply us with the CAN.*[162]

As a result, farmers had little option but to leave their vouchers at the agro-dealers, hoping to receive the CAN in time for top-dressing. Unfortunately, this did not happen and farmers were without CAN for the planting season. The timing of applying top dressing to a maize crop is critical and must be done when the maize is around 30–45 centimetres high, before the plant flowers. If applied too late, the CAN will have little effect on plant growth. Farmers who could not obtain top dressing grew increasingly frustrated and voiced distrust toward the programme and the stockists.

These problems were not unique to Khwisero. The government's late repayment to the stockists was a nationwide problem. Discussions with NAAIAP staff in Nairobi revealed that most of the stockists across the country suffered chronic repayment delays from 2008 to 2010. This led to agro-dealers becoming increasingly frustrated and unable to participate in the programme as they could not restock their shelves at the appropriate times. The agro-dealers' suspicion that the government could not properly schedule reimbursements contributed to a lack of qualified agro-dealers participating in

[161] Interview, male farmer, wealth category A, Doho, Butere, May 17, 2010.
[162] Interview, male farmer, wealth category A, Khushiku, Butere, August 13, 2009.

the programme. This led to difficulties in enlisting established agro-dealers for the programme. According to Luka Erembo, an agro-dealer in Khwisero:

> *Many shopkeepers who were part of the programme the year before, or knew other shops that had participated, heard stories of late payments, so many refused to participate.*[163]

In addition, some districts had few qualified or adequately resourced agro-dealers. Many of the stockists did not have adequate training or incentives to manage the input distribution appropriately. The government collaborated with CNFA/AGMARK, an American NGO, to train the agro-dealers in supply management and distribution. However, not all trained agro-dealers were able to participate. Some lacked the capital or access to credit needed to procure the inputs, others did not trust the government to reimburse them in a timely manner, and some blamed rising fertiliser costs that made it unprofitable for them to participate. As with the MVP, the Government of Kenya partnered with Equity Bank to offer credit to agro-dealers but not all of them qualified for this credit. This forced the government to include stockists from neighbouring Divisions and/or Districts, making farmers travel even further to get their inputs.[164]

Ana Kataka and Luka Erembo, shop owners in Khwisero, were part of the NAAIAP programme and qualified for the Equity Bank loan. However, both Kataka and Erembo were unable to pay back the bank loan on time because of government delays in reimbursing them for the inputs they had provided to the farmers. Erembo the shop owner states:

> *Yes, I was one of the suppliers under the NAAIAP programme this year. However, I faced challenges caused by a delay in payment for the vouchers. I still owe farmers delivery of top-dressing fertiliser. I failed to pay back the banker's loan in time because of the government delay in paying me for the original inputs.*[165]

Kataka also highlighted some of the problems she had with her involvement in the programme:

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[163] Interview, Luka Erembo, Agrovet dealer, Khwierso, Butere, July 8, 2009.
[164] Interview, NAAIAP Programme Officer, Nairobi, March 29, 2010.
[165] Interview, Luka Erembo, Luma Agrovet, Khwisero town, July 8, 2009.

> *One problem I had with the NAAIAP programme was that most farmers thought that the vouchers were for cash and not for inputs and they pressured us to supply the top-dressing fertilisers. However, I suffered most from the delay in payment by the government.*[166]

The NAAIAP officers were aware of these institutional and delivery problems and modified the distribution system in 2010. While unable to change the national payment structures, they opted instead to focus on adjusting the distribution channels to incorporate larger input-dealers (distributors) instead of the small agro-dealers in the sub-locations. These larger distributors are contracted at the national level to supply all inputs to certain locations during what NAAIAP staff call 'input fairs'. Farmers receive all inputs at the same time and (presumably) early enough for proper planting. Therefore, NAAIAP overcame one of its technology supply problems by controlling the distribution chain of the inputs, but only at the expense of undermining important institutional structures (i.e., agro-dealer networks), which they had originally planned to strengthen.[167]

This section illustrates some of the challenges of administering a large input-support programme. It examines the politics and highlights some of the institutional and capacity issues arising from rapid programme expansion. The programme had expected farmers to graduate from the input subsidy package in one year, but this proved to be too optimistic, since the farmer groups and cooperative cereal banks were poorly supported and did not function as intended.

The outcome of the programme

NAAIAP's main goal was to "address the problem of food security and poverty for resource poor farmers" (GOK, 2008b: 1). Its main thrust was to increase agricultural productivity by providing farmers with improved inputs, particularly improved seeds and inorganic fertiliser. However, the drought in 2009 drastically reduced yields for many farming households in the research area, with 83 percent of households interviewed experiencing a lower than average maize harvest. The households in the poorest wealth category were hit especially hard, with many of them struggling with

[166] Interview, Ana Kataka, Witinye Multi-Purpose Centre, Khwisero town, July 7, 2009.
[167] See Odame and Muange (2010) for an overview of the evolution and characteristics of agro-dealers in the cereal subsector in Kenya.

food security during the following year. Therefore, one year after the programme ended, visits to the same households showed that 90 percent of farmers felt that there was little change in their food security situation. Because households did not have the yields they expected after receiving the input package, only 13 percent of the households felt that they had any gain from NAAIAP. This last section analyses why perceptions about technology may have changed after the programme and how farmers' impressions may have altered their farming systems.

Perception and adaptation of technology package

As mentioned previously, the majority of the programme recipients (92 percent) had used fertiliser before NAAIAP, although in varying quantities and not necessarily consistently. The majority were from the highest and middle wealth categories (38 and 35 percent), while 28 percent were from the lowest wealth category. There were more male-headed households (59 percent) than female (41 percent) who had used fertiliser previously. The remaining households (8 percent) had not used fertiliser or improved seeds before the programme. All of these were in the poorest wealth category and were evenly divided between male- and female-headed households. These were relatively younger households who had recently started farming on their own and the main reason they did not use fertiliser was because of a lack of capital.

In 2010, 81 percent of farmers reported buying fertiliser for the next long rains, purchasing quantities between 5 and 50 kilograms. None of them purchased the type of inputs provided in the NAAIAP package; instead they went back to their previous choices, buying DAP and their favoured hybrid seeds. Only eight percent reported purchasing top dressing (CAN). In all, farmers returned to purchasing the same types of technologies that they were using prior to the programme.

Fewer farmers in the lowest wealth category bought inputs in 2010 than had done before NAAIAP started. These households had no coping mechanisms to deal with the poor harvests caused by the 2009 drought. Therefore, they were unable to save or continue purchasing inputs as they had done in previous years. The programme had not been able to provide them with the resilience they needed to withstand and overcome a significant environmental shock, such as a prolonged drought.

In terms of quantity of inputs purchased, wealthier households (Category A) were more likely to purchase the same inputs they had used before the programme. One such farmer remains convinced that without fertiliser he could not expect a good harvest:

> *I shall never plant without fertiliser, without fertiliser you do not expect this crop to grow*.[168]

A few farmers (25 percent) in this highest wealth category applied slightly more fertiliser than in previous years. However, none of them attributed their increased purchases directly to the programme. They were able to buy more inputs as a result of income from other activities, which included beans, soya, livestock or remittances. In addition, this group had larger plots (more than two hectares), and many of them could store and/or sell maize. Rose is one such farmer from Khushiku. Rose is a retired teacher and owns a bookstore and a small primary school. She has two hectares of land, which she uses to pant a wide variety of crops, including maize, beans, groundnuts, sunflowers and a range of different vegetables. However, she says her main source of income is from her dairy cows and from her shops in the market. She also depends on her small pension that she receives. Therefore, her income base is diversified and she has a range of options that she can depend on when she needs to purchase inputs. As she states:

Figure 18: Rose Amanya, Butere, May 2010

[168] Interview, male farmer, wealth category A, Khushiku, Butere, May 20, 2010.

> *I never plant without fertiliser and you can see the results in my yields. In half a hectare I have been getting between 15 and 17 bags of maize, if there is no drought and it rains well, and I plant on time. I have been using DAP even before the programme, and I will continue to use it even now. I would plant groundnuts and sell them around January so I can get fertiliser to plant maize. If it wasn't enough then I would use money from my dairy cow to top up what I needed.*[169]

On average, farmers in the middle wealth group (Category B) bought inputs after the programme but in smaller quantities than in previous years. Farmers in this wealth category pointed to the poor harvest of the previous year to explain why their input purchases this year were much lower. A few households in this group were able to rent extra land and sell those crops. However, overall, remittances remain an important source of income for this middle-wealth category. Michael, a middle-wealth category farmer from Khushiku describes:

> *Three years ago I received some money from a relative working in a nearby town and I used that money to purchase DAP for the first time. I had seen other farms doing well with DAP, so I decided to try it. I would not have been able to buy the fertiliser without my relative who supported me that year and I harvested my highest yield ever. I did not purchase again until the government programme came.*

After using NAAIAP inputs, Michael decided to buy DAP for the next long rains (2010). He sold a goat in the local market and purchased 20 kilograms of fertiliser to use with his local seed. He feels that the 20 kilograms of fertiliser is a positive improvement, but he remains unsure whether he will continue to purchase the inputs. He says that so much depends on the outcomes of the next harvest that he can only make plans when the season is about to start.

For the 19 percent of farmers who did not purchase inorganic fertilisers in 2010, most (71 percent) came from the poorest households (Category C). Farmers in the lowest wealth category returned to their conventional farming systems, using animal manure, compost or nothing. This group was the only wealth group in which a reduced proportion of farmers used fertiliser. Prior to the programme, 75 percent of farmers in the poorest wealth category used fertiliser (albeit in varying quantity), but this fell to 50 percent one year after the programme. A lack of financing and a poor harvest from the

[169] Interview, Rose Amanya, wealth category A, Khushiku, Butere, May 10, 2010.

previous year meant farmers could not afford to buy the following year. Many in this group rely on a small portion of land for income. Some work on other people's farms and use some of these earnings to purchase a few kilograms of fertiliser. Low yields as a result of the drought meant that many had little to sell and NAAIAP did not help them to save enough to buy fertiliser the following year. While the drought played a role, 47 percent of those interviewed also blamed the input package distributed by NAAIAP. Farmers attributed their poor yields to the performance of *Mavuno*, the seed type and the late availability of top dressing:

> *I had never used Mavuno before. They had used it in Muhanga [neighbouring sub-location] last year and I heard that it did not perform well. I am told that it was not the government pushing Mavuno, it was the agro-dealers that were trying to make a big catch.*[170]

This message was common with farmers who voiced their frustration with the administration of the programme and the inputs that they believe are not appropriate for the area. They expressed confusion as to the role the agriculture officers were to play. One poor widow states:

> *We were supposed to be visited first by the agriculture officer to tell us what to do, so I waited for them and they never came. This affected my crop because I planted late. I only harvested two bags from the place where I planted with government fertiliser. This was much lower than normal. However, the drought also affected the crops so much. In truth, I usually depend on local seed and I usually get a better harvest than this one.*[171]

A well-off elderly woman from Khushiku claimed that staff at the Nairobi headquarters were not connected to those who received the inputs in the villages. In her view, this led to frustrations in her community about the programme:

> *The major aim of the government is trying to pull us out of poverty. It is not easy because the people who make these programmes do not live here in the villages so I do not know if they understand how difficult it is to make a living from the land. You may come here and find a farmer who produces less than five bags of maize an acre. Do you not think it is a waste of time and energy? I wish they could come here and see how it is. I wish they would mix with the people from the reserves. Then it would be cheaper to solve this problem.*[172]

[170] Interview, male farmer, wealth category A, Doho, Butere, May 14, 2010.
[171] Interview, female farmer, wealth category C, Khushiku, Butere, May 21, 2010.
[172] Interview, female farmer, wealth category A, Khwisero, Butere, May 20, 2010.

The household interviews show that due to national political interest in the composition of the input packages, the programme administrators were not able to take into account the diverse social and political factors that affect local farming systems. The inability of the programme to address diversity and to include farmers in the conceptualisation and implementation affected the overall outcome of the programme and resulted in little change to farmers' socio-technical environment. Some adaptation did occur as farmers customised the technology package based on their prior experiences and knowledge of soil management practices. They mixed the fertiliser with manure, combined it with local or alternative seeds, planted or combined the inputs with other crops, and made use of the fertiliser and seed in a different way to that envisioned by the programme designers. However, the one-year time frame of the intervention was not long enough to make substantial changes. Instead, farmers incorporated the programme package into multiple socio-technical innovations that emerged through farmer experimentation and through ongoing farmer-to-farmer learning at the household level. This resulted in interactions with the input that were different and more varied than the outcomes expected by the programme.

Conclusion

Throughout this chapter, household-level case studies demonstrated how farmers dealt with the technical recommendations offered by the programme and revealed how socio-technical systems constructed in projects are transformed through highly differentiated farming practices. As with MVP, this chapter demonstrates that large-scale national-level narratives and knowledge-power-policy connections at national and local levels affect farmers' interactions with the programme and the administration of the programme. The overarching national political landscape that exists around NAAIAP did not allow for full farmer participation in the creation and implementation of the programme. This top-down approach did not allow community involvement in the process, which gave the farmers a limited sense of ownership or control, and led to distrust and frustration. In addition, the links between the national and local institutional and administrative arrangements influenced the style and form of the programme, resulting in constraints on administration staff that ultimately affected the

outcomes. Local power relations and social networks perpetuated the challenge of delivering limited resources to the intended recipients.

Meanwhile, the socio-institutional elements led to transformations in the programme's implementation. Limited human resources prevented dissemination of the programme's messages to the community and participants. Due partly to the rapid expansion of the programme and the limited capacity of the agro-dealers, the technology packages were designed without taking existing farming structures into account. As a result, the farmers did not view them as appropriate. Therefore, the overall perceptions of the input package were that it did not meet their specific needs or consider their particular preferences. The practical difficulties in the programme design (including the location of agro-dealers, establishment of cereal banks, lack of training and follow-up, etc.) engendered feelings of dissatisfaction among farmers towards the programme, the stockists and the technology itself, which meant that the NAAIAP intended outcomes were difficult to achieve. Outcomes were further affected by poor timing of input delivery that caused delays in planting and ultimately affected yields. Finally, the short-term, one-time investment and the limited administrative capacity to provide follow-up and monitoring were not enough to ensure sustained long-term results.

Overall, the ability of the NAAIAP programme in Butere to alter the local socio-technical system in the way it had intended has been rather limited, resulting in little sustained change in technology usage as originally envisioned by the policymakers. This lack of uptake was influenced by external limiting factors (e.g., lack of reliable rainfall, labour shortages and financial limitations) that remained the same after programme completion. As seen for the MVP, without changing components of the local socio-technical system that surrounds fertiliser usage for each household, the programme was unable to generate the change needed to construct a new system that would embrace the expected outcomes. The disconnect was not only with the specific technology package, which did not perform to the expectations of the recipients, but also with the wider socio-institutional dimensions, such as training, dissemination of information, agro-dealer networks, and setting up of farmer groups. However, the farmers have had an opportunity to experiment with the technology. It may not have changed people's relationship with fertiliser and may not have resulted in massive adoption rates, but through this experimentation, there has been a change in the

relationship between the social and the technical, although with limited outcomes in terms of technology adoption or improved food security.

As with MVP (Chapter 6), this chapter illustrates that adoption, adaptation and continued use of a new technology are influenced by a multitude of factors that are external to the technology itself and depend on the delivery mechanism and messaging that are used to introduce that technology to a community. It offers insights into the dynamic interactions between key internal and external factors and their effects on sustained use of the new technology. It further reinforces the ways in which local socio-technical factors, including social networks, local institutions and gender roles, affect an individual's ability to interact with a new technology and their perceptions of its accessibility, utility and affordability. Therefore, programmes that do not consider the social, ecological and technological realities are likely to face serious obstacles to long-term adoption and sustained use of a new technology.

The following chapter looks more closely at MVP and NAAIAP, to examine some of the convergences and divergences of the experiences and draw some broader lessons that could be applied to input supply programmes in general.

Chapter 8

Comparison of the Two Case Studies

This research has focused on the interface between technology and society, conceptualised as a process of co-evolution, in which the technology and social context interact and change. Building on the analysis of the previous two case study chapters, this chapter compares NAAIAP and MVP. It draws conclusions about the outcomes of the programmes and the level of change that occurred in local socio-technical practices and the wider regime and landscape framed by the Green Revolution narratives. In this chapter, I argue that the construction of this change is influenced by the unique characteristics of the farmers (and their households), including their relative wealth status (e.g., access to land, labour, capital), social standing and cultural factors (e.g., actor networks, power relations), as well as their articulation with wider social and technological processes. These socio-technical-political interactions come together to create a new version of the technology to fit the farmer's particular livelihood circumstances.

As stated at the beginning of the thesis, my research aims to move beyond a simple 'adoption' versus 'non-adoption' question; instead I have sought to determine how and to what degree contrasting input-support programmes have altered the socio-technical system and the choices open to poor farmers in risk-prone environments. The focus is on the encounter between the input supply programmes and local contexts and the creation of new hybrid interpretations and practices. At the same time, the results show that changes in the local socio-technical systems have a discernable impact on programmatic outcomes.

In socio-technical terms, the two case studies are quite different. They are situated in two distinct areas, with unique cultures and diverse livelihood/farming systems, as well as different histories of exposure to fertiliser and experience with its use (see Chapter 5). While driven by a similar Green Revolution technology-focused narrative, the two programmes have very different designs, administrative arrangements and

organisational structures (e.g., scale, budget, targeting). Therefore, a direct comparison cannot be made, since it is not a replicated experiment with the same intervention (beyond the input focus) in the same context. However, a comparative analysis can draw out key lessons that could be relevant to the design and implementation of future input-supply programmes. Therefore, based on this premise, the next section begins with a closer look at some of the similarities and differences in the design and delivery of MVP and NAAIAP.

Comparing the design and delivery of the input-support programmes

As highlighted in the previous chapters, the socio-technical system present in MVP and NAAIAP has emerged through a unique set of institutional and administrative arrangements. Both programmes originated through, and were influenced by, particular political interests and organisational constructs. Furthermore, both programmes were dependent on additional donor support to scale up the activities and were driven by funding exigencies. Therefore, key actors (including government, donors and input suppliers) were instrumental in shaping the evolution of the programmes, couched within national (NAAIAP) or household (MVP) food self-sufficiency objectives.

The philosophical foundations of both programmes were derived from the overarching Green Revolution narratives of addressing a productivity gap through providing a simple technology fix. Specifically, inorganic fertilisers were seen as the missing factor that could boost productivity on smallholdings. The rationale was based on statistics showing that productivity levels and use of inorganic fertiliser were low in Kenya (and in Africa generally), and it was assumed that subsidising the input would lead to farmers adopting the technology and improving their productivity and ultimately their food security status. However, in both programmes, a disconnect developed between the original strategic objectives and the policy-setting agendas of the headquarters-based administrators, due to emerging institutional and/or organisational barriers and changing realities in the field. Table 4 highlights some of the key differences and similarities in the design, implementation and overarching narratives of the two programmes.

Table 4: Comparison of the two input-support programmes

	MVP	NAAIAP
Scope		
• Geographical reach	Site-intensive (operates within one district – Siaya District)[a]	National programme (operates within multiple districts)
• Beneficiaries reached (2008)[b]	12,700 households within one district	96,000 households within 70 districts
• Scope of activities	Integrated programme (multiple initiatives within the same location)	Inputs-only programme
• Percent of subsidy	89 percent (10 percent of yields paid back to MVP for the school feeding programme)[c]	100 percent
Targeting		
• Criteria	Initially universal subsidy; shifted to targeted subsidy for vulnerable population	Targeted subsidy with a list of beneficiaries based on set criteria
• Beneficiary selection process	MVP staff in consultation with village-level committees for vulnerable targeted programme	Village Elders and Chiefs
• Targeting mechanism	Direct delivery and vouchers	Vouchers
Package		
• Package content	Decreasing over time and varied. Package included planting fertiliser + maize seed + top-dressing fertiliser	50 kilograms of planting fertiliser + 8 kilograms of seed + 50 kilograms of top-dressing fertiliser
• Cost per input package	Approximately $86 per package in 2005 (cost varied over the years as package sizes changed and prices for inputs fluctuated)	Approximately $90 per package in 2009 (cost of input package fluctuated based on cost of fertiliser)
Administration		
• Organisation	Donor-driven (NGO and donors)	State-led (government funding, expanded funding from donors)
• Level of administrative support	Intensive staff/expert support, including extension officers, plus additional external experts	Limited staff and expert support, use of existing extension officers plus farmer reps
• Length of programme	2–3 years' benefits, over a 5-year programme	1-year subsidy, on-going national programme
Delivery		
• Input supply	Contracted private companies (international and domestic)	Contracted private companies (domestic)
• Input retail	Varied over the years: direct distribution, private-sector dealers, private company and commercial bank loans	Private-sector distributed inputs (agro-dealers)

Notes: (a) MVP's operations in Garrisa District (Northeast Kenya) are not included since it does not have an input-support programme. (b) Both MVP and NAAIAP have different numbers of beneficiaries depending on the year of operation; therefore, the table highlights the total number of households that received inputs in 2008. In 2009/10, NAAIAP increased to 187,000 farmers in over 100 districts, while the MVP began its credit programme and reduced the number of recipients receiving subsidised inputs. (c) Ten percent repayment was a condition on receiving the subsidy. MVP quantified the repayment of maize and beans using government maize prices and market value for beans, deducted this total from total cost of the inputs, to state that the total subsidy for 2005 was 89 percent (Mutuo et al., 2006: 11).

While the scale, implementation and administrative structures of the two programmes are different, the focus is very similar, and so are the wider narratives associated with each. As mentioned previously, both programmes were derived from the Green Revolution narrative, with a particular technology-driven pathway to addressing food insecurity among smallholder farmers. The overall results may vary, but the respective constraints and interactions with the farmers are quite similar and, in both cases, the programmes were unable (in different ways) to take into account the social and cultural dimensions of technological change.

The following section compares key design and implementation features of the two case studies.

Community outreach and exchange of information

MVP had an intensive focus on community outreach and training. Most of the project farmers had not used fertiliser before and so the training centred on increasing their knowledge and understanding of the technology. Universal subsidies in the early years encouraged many among the community to experiment with the technology. This created social pressures in which farmers did not want to be left out and were encouraged to copy their neighbours. MVP relied on a vast network of extension staff and agriculture facilitators to introduce the technology and conduct training. Continuous follow-up throughout the initial years also helped some members of the communities to acquire knowledge. Universal coverage of the entire sub-location also resulted in greater farmer-to-farmer knowledge sharing, as all farmers were using the same technologies.

In contrast, the majority of the farmers chosen to receive the NAAIAP subsidy had prior knowledge of and experience with inorganic fertilisers. Yet, due to the lack of training and follow-up, the programme did not expand the farmers' knowledge and they gained little new information. In addition, the size of the target group limited the extent of farmer-to-farmer exchange and there was limited awareness of the programme and its objectives within the wider community. The lack of sufficient human resources hampered NAAIAP's dissemination strategy and its messages did not to extend into the

wider community. In addition, the NAAIAP input package was disbursed widely, with roughly 100 households in each sub-location, which translated to eight farmers per village. Targeting small numbers of recipients meant that farmer-to-farmer exchanges were much less prevalent in Butere. Furthermore, there was no properly organised information dissemination programme, due partly to a lack of available staff, so the farmers received insufficient information.

Participation of end users and appropriateness of technology package

While some community members were involved in certain aspects of the MVP programme design, the overall design and direction was led by project staff, with community committees filling the role of information dissemination. For example, while the large number of extension officers and agricultural experts working with the programme allowed MVP to do more field-testing and offer inputs that were tailored to the environment, the final decision on input types was viewed by MVP as a technical decision and was made by MVP staff. Even though the village committees were formed specifically to involve the community, a degree of 'elite capture' of committees was observed, with those who were relatively more advantaged and closely allied with the local power structure gaining access to leadership positions within the committees. While in general, farmers were satisfied with the MVP package of inputs, there were complaints about the quality in more recent years, when the inputs were purchased from agro-dealers or when the farmer's choice of seeds was not available in the markets.

In NAAIAP, the communities were not involved in programme design and implementation and this was demonstrated in the farmers' lack of knowledge concerning the programme goals. However, since the Assistant Chiefs and the village elders were responsible for the list of participants, this process reinforced existing power structures and ensured that local leaders and rural elites dictated who benefited from the programme. Likewise, NAAIAP recipients had no choice in the composition of the input package. In many cases, the recipients did not view the inputs offered by the agro-dealers as appropriate to their area.

Capacity of administration and street-level bureaucrats

An interesting sub-theme emerging from this research is the influence of field-level agents or 'street-level bureaucrats' (Lipsky, 1980) in translating policy into practice at the interface between farmers and the technology delivery. Delivery agents, who include programme administrators, extension officers and field staff, affected the outcome of the programmes when they translated the policies created at the macro or meso levels into practice. Local socio-technical interactions were altered by the interpretation and discretion of the field-level agents. As Keeley and Scoones (2003: 32-33) describe:

> *[Street level bureaucrats] prioritise, interpret instructions, deal with overlapping and contradictory directives, and take the initiative in areas where there might be a policy vacuum. Even where directives are clear, street-level workers can block, deflect or ignore instructions.*

The field-level agents were able to exert a subtle but significant effect on the agenda and direction of the programmes through their interactions with local people. Their role was played out differently in each programme. For example, the shift in NAAIAP's targeting criteria took the focus away from the most vulnerable in the community and towards those who were 'serious farmers', so including a different group of beneficiaries from that originally envisaged. Likewise, in MVP, field agents made critical choices regarding budgetary allocations that changed the length and scope of the subsidy period, which led to a transformation in the local approach.

There were also differences in field-based capacities between programmes. MVP's administrative structures were strong, since the programme existed for five years in the same location and had sufficient funding to hire trained extension officers and specialists. This allowed MVP administrative staff to understand the programme area and build long-term relationships with the communities. In contrast, NAAIAP depended on the existing and under-funded government extension staff to administer the programme. NAAIAP's administrative structures were stretched by the need to cover a rapidly increasing number of farmers and large areas with inadequate financial and logistical support.

Building institutions to ensure sustainability

Sustainability is another critical component for development programmes. To be sustainable, subsidy programmes need to promote the development of the institutions required to make a substantive change in the local area. Input-support programmes need to address the broader market factors affecting smallholder farmers, which include availability and costs of inputs, price fluctuations of staple products and lack of affordable credit or insurance schemes. Both NAAIAP and MVP designed institution building into their programmes, with varying degrees of success. Yet, the evolving nature of both input programmes hampered the building of lasting institutions in different ways.

The agro-dealers created during MVP have not survived and the micro-finance institution initially involved has not flourished. MVP built the agro-dealer networks but then abandoned the idea in favour of larger input distributors. However, since MVP is a multi-year and multi-sector programme, it has been able to expand its focus and promote diversification and market-oriented activities.

On the other hand, NAAIAP's short timeframe of operation within a given sub-location allowed little opportunity for institution building – or even the strengthening of existing institutions. While community cereal banks were discussed, few were established due to the limited capacity available for training and follow-up. Although training of agro-dealer networks did occur on a national scale, the lack of appropriate financial mechanisms to refund them in a timely manner made it difficult for small-scale agro-dealers to participate in the programme. NAAIAP was unable to depend on the small-scale agro-dealers to supply the appropriate inputs at the right times and, therefore, the programme began to rely more on the larger state-controlled distributors. Hence, there has been little impact on expanding the network of agro-dealers, as originally envisioned by the programme.

Political and external pressures on programmes

The pace of implementation and expansion of both programmes greatly affected the ways in which the technologies were introduced to the community, the participation

and engagement of the recipients and the administrative capacity of the programme staff. All these factors affected the co-construction process between the technical and the social worlds, with varying results.

The MDG was driven by external pressure to demonstrate rapid success and to provide a 'proof of concept' behind the global MDG Agenda. This political and external pressure to show quick results pushed the MVP administrators to proceed at a pace that did not allow local government officials and local communities sufficient time to adjust to the constant changes. MVP was quick to change the delivery format of its programme but the fast-evolving system was not explained properly to the community, leading to confusion and frustration.

Similarly, NAAIAP was largely driven by the convergence of national electoral (political unrest leading up to the 2007 national elections) politics and food security (based on an emphasis on maize production) concerns. Social and political pressures, following the droughts and national–level unrests that occurred in early 2008, affected implementation and prompted rapid expansion of the programme, while increased donor support (interested primarily on social protection after the electoral violence) outstretched the capacity of the staff, extension officers and agro-dealers to implement the programme. Ultimately, political factors, heavily influenced by social factors, underpinned the final project design and implementation.

Both programmes illustrate various ways in which social and technical processes interact and co-evolve. The rush to show results at the local level prompted the narrowing of Green Revolution narratives, with policymakers enticed by the promise of quick wins from improved seeds and fertilisers. Yet, Green Revolution narratives implemented through policy and programmatic instruments may influence local socio-technical changes, but they do not determine the direction or extent of these changes. Instead, the two case studies show how the farmers' socio-technical systems have been fundamentally reshaped or reconfigured, not by externally driven narratives, but as a result of local level interactions among farmers, the technologies themselves, and the programmes that promote them.

Comparing results and outcomes of input-support programmes

As mentioned at the beginning of the chapter, this research focuses on the socio-technical factors that come to play when technology dissemination programmes are introduced at the household level. The case studies demonstrate how the farmers' individual socio-technical worlds are altered as a result of their interaction with a particular technology and its implementation processes. This results comparison focuses on the construction of this change by highlighting some of the main outcomes of the two case studies. It also refers to other, similar programmes in Africa, indicating common similarities and differences (cf. SOAS et al., 2008; Dorward, 2009; Xu et al., 2009; Baltzer and Hansen, 2011; Ricker-Gilbert et al., 2011; Mason and Ricker-Gilbert, 2012).

In both MVP and NAAIAP, the adoption and continued use of the technology packages were influenced by many external factors, including the changing delivery mechanism and messages. One important outcome in both programmes was that withdrawing the subsidies affected the usage rates of the technologies. For example, the one-year subsidy offered by NAAIAP was much too short term to have a significant influence on farmers' fertiliser usage rates. Likewise, withdrawing or altering the subsidy programme too quickly, as in MVP, affected the relationship between the farmers and the project and hampered adoption rates as people's expectations for continued support were not met. In addition, external factors, including weather and administrative delays, heavily affected the farmers' ability to cope with ongoing risk factors, so many farmers reverted to their former farming practices.

Similar results concerning declining input use after the withdrawal of input-support programmes are reported in reviews of several large-scale African universal subsidy programmes operating during the 1980s and 1990s (cf. Crawford et al., 2006; Dorward, 2009; Baltzer and Hansen, 2011; Banful, 2011). A study by Reardon et al. (1996: 18) found:

> *In Zimbabwe, smallholders rapidly adopted hybrid maize when fertilizer credit was available and output market prices were guaranteed. When fertilizer credit was eliminated in 1985, fertilizer use declined.*

Results in terms of poverty alleviation were affected by the programmes ability to target the subsidies to appropriate recipients. Both programmes (MVP and NAAIAP) tried a variety of voucher and credit schemes. The voucher scheme used in NAAIAP had the potential to target the subsidies to specific smallholders, but social structures and power-relations at the local level affected the process. As a result, households with better social and political connections were more likely to receive the targeted inputs. For example, male-headed households were at times represented as female-headed so they could benefit from the programme, leading to a skewed distribution of benefits.

The targeted vulnerable programme in MVP was able to overcome some of these difficulties and improve its reach because programme staff built close relationships with community members, including village elders, during a relatively longer period of time (two to four years). This process was facilitated by having sufficient numbers of qualified, well-paid and motivated field staff dedicated to implementing the programme. However, the high level of funding required to replicate such intensive supervision has financial implications for the scaling up of the programme to the national level, as well as for an adequate return on donor investment.

Similar problems with targeting were found in the Malawi subsidy programme. The official criteria for choosing recipients were not very precise and, like in NAAIAP, selection was left to the village elders and chiefs. For example, a survey by Holdon and Lunduka (2010) found that the pro-poor targeting (aimed at the very poor and vulnerable child-headed and female-headed households) was inefficient, with male-headed households and households with greater assets and incomes receiving a large share of the subsidised inputs. This social discrimination meant that the most vulnerable households in Malawi were less likely to be considered for the inputs (Chibwana et al., 2010). These results put into question the effectiveness of targeting to particular farming households, due to problems of diversion and leakage.

Comparing the productivity outcomes is much more difficult, due to the different length and coverage of the two programmes. NAAIAP farmers in the study sites did not report sustained increases in productivity during or following the one-year programme. A period of low rainfall coincided with the subsidy period, and this had a strong

negative effect on farmers' yields. However, in Siaya, early results indicated yields increased up to 2.6-fold from 2004 to 2005 (Sanchez et al., 2007: 16777). In this area, the subsidy coincided with good rains and included intensive training to improve farming practices (i.e., spacing, weeding, and seed and fertiliser placement). The results after the MVP subsidies were withdrawn have been mixed, with overall yields declining slightly since the initial highs reported at the beginning of the programme (Okoth, 2010).

These findings are in line with those of other authors. For example, Baltzer and Hansen (2011: 28) state:

> *Significant increases in agricultural productivity and food production is possible, and the potential for improving agricultural productivity by subsidising agricultural inputs exists. However, the estimates are somewhat uncertain. .... There is very little convincing evidence to suggest that outcomes are likely to persist after termination of the programmes.*

National- and global-level politics have also influenced the outcomes and sustainability of these two input-support programmes. As mentioned in Chapter 3, input-support programmes have the potential to lead to rent-seeking, clientelism and elite capture at all levels. Therefore, political interference and controlling costs becomes paramount, and this can be difficult for programmes such as NAAIAP, where there is strong political advocacy for the expansion of subsidies and strong resistance to scaling down or termination of the subsidies. Chirwa et al. (2010: 1) report that the cost of the Malawi subsidy programme increased from 2.1 percent of GDP in 2005/06 to 5.5 percent in 2008/09.

The lasting outcomes on food security in both research sites are still unclear. As stated in earlier chapters, food insecurity relates not only to availability of food but also to issues surrounding access to and stability of the food supply. Therefore, assessment of impact requires a broader view of the different factors affecting food security, which include ecology, social dimensions and political economy. A study by Richer-Gilbert and Jayne (2011) found that, although it was successful in increasing production, the Malawi programme showed little evidence of a long-term positive effect on the income, assets, access to food or general well-being of poor households.

Comparing the outcomes of NAAIAP and MVP demonstrates the complexity of the relationship between input-support programmes and long-term food security. Some proponents of these programmes state that lowering the cost of farm inputs is a good way to reduce the risk associated with using a new technology. Others criticise subsidies and view national policy reforms or market liberalisations as the key. Both these views are based on a certain "theory of change" (Kubisch et al., 1995; Weiss, 1995, 2000; Stame, 2004) that centres on the ideas that the administrators, policymakers and implementers of programmes have on how inputs will be received by the recipients. Yet, whether the subsidy programme are justified under one or the other of these positions will have an impact on the environment (i.e. institutions and policies) that will need to be in place for the subsidy to be successfully withdrawn and for the farmers to continue using the inputs.

Based on my research, I contend that narrow focuses on technologies or market-based solutions will not be sufficient to address the complex nature of food insecurity. The answer must incorporate a broad approach that considers the unique political, institutional and social contexts that surround local farm settings. Technology-driven programmes must allow for the fact that end users will adapt these technologies through individualised social interpretations, localised institutions and political processes. Therefore, the social and human factors that affect change and the dynamic interface between technologies and human interactions need to be better understood.

Conclusion: The divergence of policy and practice

The two case studies show that policy and practice often diverge, even with well intentioned deliberative processes. They show how programme design can evolve in a different way than expected due to certain social, political and economic factors, funding and delivery systems. They highlight how related policy processes unfold through changing actors, networks and funding flows. When a programme hits the ground, it takes on its a life of its own, one that is mediated through socially differentiated beneficiaries who represent the different categories of adopters, non-adopters, dis-adopters and partial adopters. This research attempts to understand the

challenges, capacities and priorities of a diverse group of actors and interests and the relationships between their social worlds and Green Revolution-inspired technologies.

The analysis of the interactions within NAAIAP in Butere offers lessons for the design of an effective technology delivery system. The programme's administrative problems, lack of training and absence of input choice were compounded by the poor rainy season, leaving many people disillusioned and feeling that the programme was not as successful as it should have been. However, the lessons from NAAIAP in Butere in terms of socio-technical influences are more complex than they first appear. This research shows that the design of the programme, in terms of the recommended input package, was influenced by political and administrative factors at the national and local levels.

MVP was also influenced by numerous multi-level interactions at the national, programme and local levels, leading it to undergo a number of modifications and administrative 'retooling' over the years. The MVP concept underwent numerous renegotiations between key actors. This co-evolution of technology and society resulted from the changing politics of the relationship between headquarters and the field and the tensions that existed among framing, funding, implementation and practice. As highlighted in Chapter 6, some of the changes were due to challenges encountered in the field, while others were the result of the broader political, economic and institutional context. In addition, some changes came from the project's need to show results faster than field staff and villagers could adapt. These interactions resulted in an evolving system, both at the programme and the farmer level, which continues to be transformed over time.

The analysis demonstrates that, in practice, programme implementation unfolds in nonlinear and often unexpected ways. Factors at one level interact with those at another. For example, the social encounters at the project interface with the community are a major factor in determining how the recipients understand, implement and accept the programme. Furthermore, these social and political factors come together with the project implementation, financing and administration to create diverse trajectories and reshape the original intentions. The simple blueprint design dictated at the macro level does not lead to a neat outcome, as envisaged by the programme administrators and

political actors. At the local level, these multiple negotiations and micro-politics of what is and is not incorporated become more significant, and this is where the macro-level narratives are recast to become more locally specific and socially founded.

Thus, the interface between social and technical factors remains the most important aspect determining technology adoption. The interactions among local actors, through gradual experimentation and learning processes, as well as their interactions with local administration, politics and delivery mechanisms, result in alteration of the technology package and creation of innovative niches to fit their individual circumstances. As a result, multitudes of new socio-technical arrangements were co-constructed and the farmers' relationship with the inputs was altered. Farmers' negotiations with the new technologies, and the way their knowledge was changed, enabled them to determine whether the inputs were appropriate to their local and individual context or not. It may not have resulted in adoption at the rates promoted by the programmes, but farmers' knowledge of the technology changed to varying degrees.

Ultimately, this research demonstrates that programmes must consider the socio-economic realities of poor farmers, and offer more site- and context-specific responses that are suitable for complex, diverse and risk-prone farming systems. Only then will programme managers understand the obstacles to long-term adoption and sustained use of any new technology. Promoting long-term sustainability therefore requires a deeper understanding of the wider social, economic and political factors that affect a given locality and how individuals create innovative niches to respond to these factors in a way that benefits them the most.

Chapter 9

Conclusion:

Re-imagining the Green Revolution

This thesis set out to provide a critical reflection on what is meant by a 'Green Revolution for Africa' and to highlight features of the overarching framing of food security that are missing within Kenya. It centred on one of the dominant narratives that defines the Green Revolution narrowly within a 'productivity-technology fix' paradigm, creating a limited view of technology as the principal means of addressing food insecurity in Africa. The thesis shows that this exclusive focus on productivity, instead of a more comprehensive view of the economic, social and political factors affecting food security, has led to various policy decisions concerning the delivery of technology to the food insecure. The findings suggest that Green Revolution programmes must consider a more nuanced and context-specific approach that takes into account the diversity of the local situation and the socio-economic, institutional and political factors that affect it.

The research identified a series of competing national-level food security narratives in Kenya, of which the productivity narrative was dominant. Kenya's rising levels of food insecurity and persisting low productivity have forced the government and donor community to refocus on agriculture, specifically on maize, the staple food of the poor. This has led to national policies based on Kenya's political, economic, social and historical context. The research shows how this renewed focus on food security has resulted in a certain trajectory based on raising maize productivity, with input-support programmes being promoted as a major tool to deliver technology and increase productivity among smallholder farmers. This has much to do with politics and the high political profile of maize in Kenya. The findings suggest that food security narratives supported by key global and international actors and institutions tend to dominate food security policy and legislation processes in Kenya, while marginalising alternative narratives that include a social dimension.

This chapter provides an overview of the finding, draws out key lessons regarding the effects of Kenya's political and institutional environment (Chapter 5) on MVP and NAAIAP and highlights the potential implications for these and future programmes. The key elements are summarised below.

- **Context matters**: Technologies cannot be examined in isolation; they are being adapted constantly by the end users due to social interpretations and interactions, together with the influences of local institutions and policy processes.

- **Politics and interests matter**: The adoption and sustained use of fertiliser in Africa is linked intrinsically to the perception of the actors, organisations and social structures that encompass local farming systems, which, of course, vary from place to place.

- **Dynamics and diversity matter**: Programmes that attempt to introduce a technology to smallholder farmers without taking into account the social, political and institutional dimensions surrounding that technology will encounter many difficulties in adoption and uptake.

- **Simple techno-fixes do not work**: Focusing on simple, limited solutions, such as inputs only, to such complex and multi-faceted problems as food insecurity, will address the symptoms but not the underlying causes of low productivity and deepening poverty. Long-lasting and sustainable solutions require a much broader approach that includes additional elements (e.g., markets, policy, institutions, etc.).

- **'One-size-fits-all' does not work**: This research highlights the complex and diverse nature of smallholder farming systems, which feature a wide range of dynamic farming practices and risk mitigation strategies based on the individual's social and power relations. Generalisations and fixed strategies are therefore unlikely to succeed over the long term.

- **Development takes time**: Long-term funding and programmes that take a flexible approach to planning for the future are more likely to promote change and sustainable outcomes.

Overview of findings

The findings demonstrate that previous Green Revolution narratives focused on technology fixes created a stable configuration of institutions, processes and supporting policies that persist today and continue to direct the trajectory of development programmes dealing with food insecurity in Africa. These global productivity-technology fix narratives have had a strong influence on Kenya's agricultural policy and its efforts to address the food security challenge. The influence is both historic, resulting from the institutions and land-use patterns put in place before independence, and current, linked to pressures arising from structural adjustment and market liberalisation.

The research provides a greater understanding of the dynamic interactions among current Green Revolution narratives as they come together at multiple levels. It also throws light on their effects on the design and implementation of specific input-support programmes for smallholder farmers. It shows that leading global and national actors have retained a strong focus on increasing productivity through the application of a relatively narrow selection of agricultural technologies (i.e., hybrid seed and inorganic fertilisers). However, it was the interface between the different actors that ultimately determined the technical design, dissemination and adoption process and the project outcomes. The results show that politics and power play a key role in determining whose knowledge is included or excluded at the different levels, from global agenda setting, through national policy deliberations, to local community interactions.

The policy decisions resulting from the coming together of Green Revolution narratives have framed the current agriculture and food security environment, which has a strong focus on maize production as a measure of national food security. Technical and political issues have become intertwined in the policy process and are influenced heavily by ethnic and regional politics. A focus on food security creates political

benefits, with the potential for winning votes, and therefore takes centre stage in setting the country's agricultural agenda. The result is that policy is not linear and influences can come from an array of different political and social directions and pressures, both domestic and international. Overall, the findings demonstrate that political and social pressures to respond to the food security challenge continue to dominate and shape policymaking and programme design in Kenya, and Africa more generally.

The research also focuses on social and power relations and how socio-technical systems are constructed at the village level. The household-level stories reveal different dimensions of the intersection between the technology and the farmers' interpretation and perception of its value. It reveals that farmers' perceptions are influenced by political, institutional and social factors and highlights the important role played by social networks in helping or hindering access to technology and information.

Several findings stand out from the case study analysis, particularly the importance of accurate targeting, which relies on a complex combination of political, institutional and social aspects. For example, there was a strong political rationale (i.e., improve food security amongst the most vulnerable) for the proposed targeting in NAAIAP, but the targeting system implemented created potential for elite capture. This example shows how power dimensions at the local level can affect an institutional process.

The MVP involved the community to a greater extent in targeting, yet this process was also affected by political and social factors. Social pressures were created when some community members benefited more than others through their involvement in the programme (i.e., access to information and privilege) leading to tensions within the community. In addition, while the programme's large administrative structures attempted to encourage community participation in its design and implementation, they also had the unintended results of reducing autonomy within the community. For example, the changing design of the input supply system was not discussed with the community and very few alternatives were offered to those who did not wish (or could not) participate in these structures.

Farmer adaptation of technology was another recurrent theme in the research. The two programmes under study were representative of more traditional agricultural

development projects, which tend to disseminate ready-made technology ‘packages’, since it is impractical to offer a variety of packages fully tailored to individual circumstances. These packages are often designed by experts, yet influenced by political interference and financial considerations. However, farmers rarely use a package as it comes, they will adopt it, adapt it to fit their own particular circumstances or avoid using it altogether. Because households live in different social worlds that are determined by wealth, age, gender and social connections, they deal with the package in multiple ways. This is the point at which social and institutional factors interact and the outcome of technology use is determined.

The research investigated the social processes that determined whether the technology would persist, change or disappear and thus create new socio-technical arrangements. As highlighted in Chapter 8, input subsidies are a useful means of increasing productivity and can have a positive impact – but mainly during the time of the subsidy. Once the subsidy period ends, circumstances will lead to a variety of different results as the socio-technical system changes. The nature of these changes is perhaps a more interesting issue than the standard adoption or dis-adoption question. For example, when people try fertiliser, or change the way they use fertilisers, as a result of a subsidy system, they may not adopt the new technology in large numbers, but their knowledge of the options available to them is enhanced. They now have access to a new set of options, based on a revised set of circumstances and knowledge, resulting in transformed social arrangements surrounding the technology.

Yet, the ways in which these changes occur and the system is transformed will be different depending on people’s relative wealth, gender or social standing. For example, the findings also highlight the ways in which relatively asset-poor people may perceive the technology intervention as a social or financial risk. Their interactions will differ depending on their increased vulnerability to these risks and the coping mechanisms they have available to deal with uncertainties. Because they are asset-poor (and possibly socially excluded), these farmers have higher vulnerabilities and therefore their ability to adapt or adopt new technologies are affected.

Through these case studies, the research also demonstrates how social and technical elements are co-constructed through a process of engagement at the field level.

Interfaces between farmers and technical project staff are points of negotiation and transformation of the socio-technical system. While influenced by powerful narratives – defined at the national and international levels – which project a particular vision of the Green Revolution as a 'technical fix', a whole set of negotiations takes place at the interface between project delivery and people's day-to-day lives, which result in diverse, sometimes unexpected, outcomes. As Scoones et al. (2005: 2) state:

> *Intermediate factors – social relations, politics, institutions – all imbued with power relations, and the interaction of interlocking constraints, all affect how inputs (technologies and development interventions) and outputs (development outcomes, including poverty reduction) are related.*

Bringing all these aspects together, this research makes a unique contribution to the input subsidies debate that is both conceptual and empirical. It applies a novel and hybrid conceptual framework that combines a socio-technical systems theory with a policy approach to fit the specific agricultural, socio-cultural and technological context of the case studies. By using a comparative study of two distinct input support programmes within the same country context, the research provides new insight into how influential the pressures of politics, social pressures, power relations and administrative constructs have been on the development and delivery of technology-support programmes and interactions with smallholders' at the micro level. Both advance our understanding of the use of technologies within a Green Revolution agenda in Africa and offer new insights into current debates about the delivery of input subsidy programmes.

Using the hybrid framework, the comparative analysis of MVP and NAAIAP demonstrates how programme implementation unfolds in nonlinear and often unexpected ways due to the multiple and varied interactions of intermediate factors – social relations, politics, and institutions, which at one level have influenced those factors at another level. These encounters across levels, and between the project and the community, are a major factor in determining how the recipients understand and/or accept technologies.

Through a multi-level perspective, the research showed how social and political factors interact to create diverse trajectories and reshape, or diverge from, the policymakers

original intentions for the input-support programmes. Therefore, the original design and intentions at one level do not lead to expected outcomes at another level. These multiple negotiations and micro-politics of what is and is not incorporated become more significant, and this is where the macro-level narratives are recast to become more locally specific.

The research, therefore, advances a greater understanding of this interface to illustrate how these linkages between technology and intermediate factors are important aspects determining adoption. The analysis of these interactions highlights the complexity of the relationship between input-support programmes and long-term food security. It also offers a number of practical lessons for the design of future smallholder technology-delivery programmes. I highlight five key findings below:

- Short-term subsidies or withdrawing direct subsidies too quickly may hamper adoption, due in part to people's expectation of continued support. Programme designers must consider upfront the graduation from a subside programme and understand the theory of change that underpins adaptation. Therefore, prior to implementing a programme they should establish the necessary conditions (institutions and/or policies) to ensure sustainable graduation of the subsidies to occur.

- High levels of agricultural inputs are likely to produce a rise in yields, but may not necessarily result in higher economic returns, due in part to external risks (e.g., hailstorms, floods, pests, market failures or political turmoil), and this may affect adoption rates. External shocks can also upset the administration of a programme and diminish expected outcomes. Building in resilience to such unforeseen external shocks and events is important, but rarely considered in programme design. Programme designers must build in flexibility into their programmes to adjust to these shocks and unforeseen events. However, changes to the programme's design cannot be rushed and must be properly incorporated with the involvement of the community to ensure buy-in and acceptance.

- Proper targeting is essential to ensure the inputs get to the intended recipients, otherwise there is a tendency for richer and socially better connected farmers to receive them preferentially. Programme designers must incorporate appropriate measures to ensure that programme staff work closely with the community to appropriately target the recipients and remain readily available on site to investigate discrepancies and address problems that might arise during the implementation of the programme. Constant monitoring and wider participation by the community will help ensure that both the community and programme staff are able to vet the list and thereby improve the targeting process.

- Investing in building a network of agro-dealers will not necessarily create sustainability, since these institutions will be over-reliant on demand from project farmers, which may not be sustainable. Centralised private delivery systems (e.g., Millennium Farms) may be more effective than decentralised agro-dealers, but they are more difficult and costly to administer. Therefore, programme designers must work with all stakeholders, including the communities and local input suppliers involved, to consider the type of institutional arrangements and policies required that would allow for the successful removal of the subsidies.

- Large input-support programmes are often hampered by administrative capacity and budget restrictions that affect their operation and reduce their ability to reach farmers with appropriate messages and create the institutions needed to ensure sustainability. Programme designers must appropriately balance the expected outcomes for local change against the high level of funding required to ensure intensive monitoring and supervision, including the financial implications for scaling up of the programmes.

Benefits of combining multi-level socio-technical systems and policy narratives perspectives

The research used a multi-level socio-technical systems perspective to gain insights into how social and technical aspects interacted between micro- (niche), meso- (regime) and macro- (landscape) levels. The multi-level perspective was combined with an

analysis of policy processes, which mapped out the actor networks and narratives operating in and across these different levels. This provided me with a unique conceptual framework within which to ground my empirical case studies and advance the understanding of the Green Revolution agenda in Africa, and input subsidy programmes in particular.

By taking a multi-level socio-technical perspective, this research has outlined how various processes of negotiation and translation take place throughout the different levels. Drawing on the multi-level framework presented in Chapter 2, Figure 19 (below) conceptualises my interpretation of Kenya's socio-technical environment and the different factors that affect adoption, as seen through the multi-level lens. It situates the two input-support programmes within this framework and draws upon the previous chapters to highlight some of the key factors and actor networks that are influencing the socio-technical systems at multiple levels.

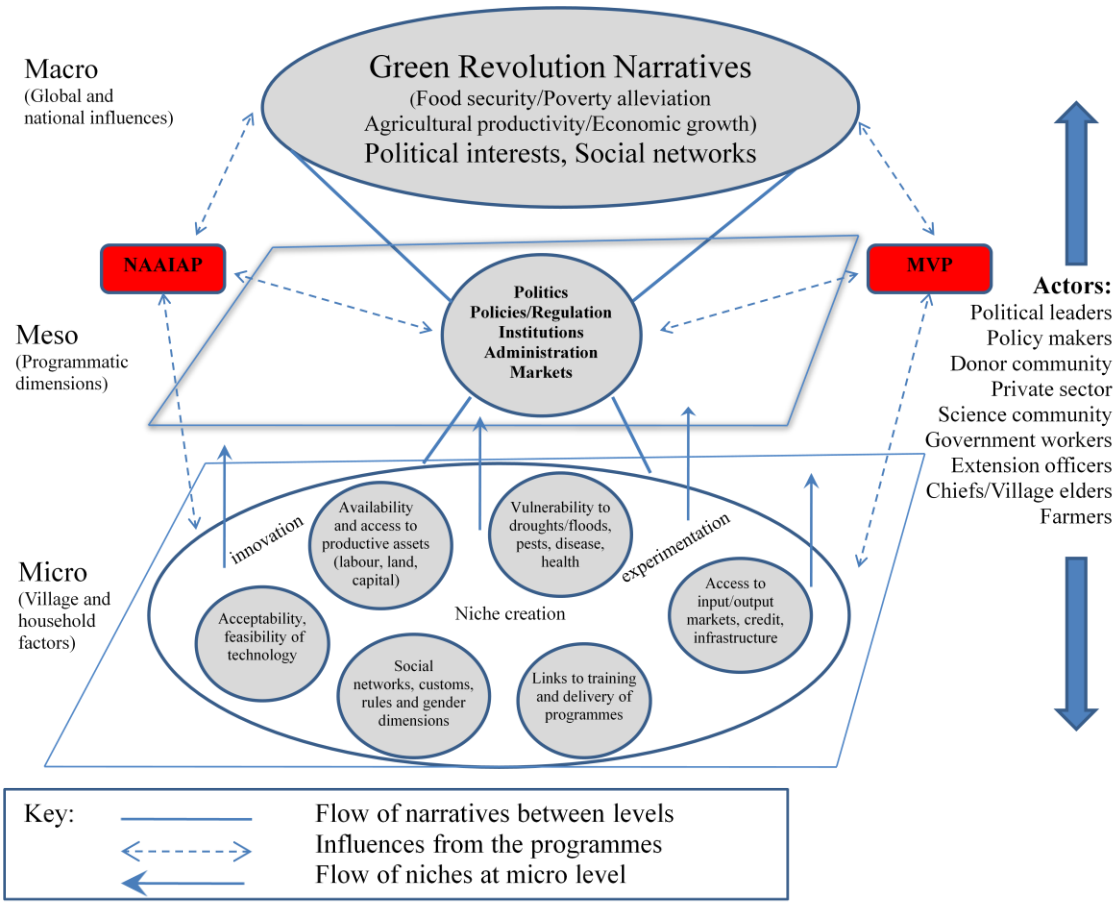

Figure 19: Kenya's socio-technical dimensions of technology use and adoption

The figure illustrates how the global landscape, within which particular political interests and actor networks frame the Green Revolution narratives, influences Kenya's national policy formulation, institution building and agricultural programming. However, these national political framings are influenced not only by global debate on soil fertility, agricultural productivity and the interests of policy elites within governments and the donor community, but also by programme experiences and the realities on the ground. Therefore, global Green Revolution narratives become integrated within Kenya's unique national socio-technical system, reinforcing the institutions, techniques, practices and networks that create a certain technology-focused regime and framing the food security narratives and subsequent solutions.

The NAAIAP and MVP are depicted within Figure 19 to demonstrate how these programmes are embedded in this multi-level system. The dotted arrows illustrate the impacts of macro-level politics of the global MDGs and high-profile development and political actors negotiating with financial allocations, delivery systems and existing institutions at the meso- and micro-levels. It shows how the programmes are affected by unique institutional and administrative arrangements at the meso-level and how these influence the implementation of the programmes and the sustainability on the ground. It is at the interface of these multiple levels that the real effects of politics, power and social arrangements on socio-technical systems become apparent.

The findings build on the multi-level framework to show that the global- and national-level narratives fail to capture the dynamic nature of farmers' practices in the field, due to the multiple micro-level factors (social, economic, political, ecological and institutional) that shape the farmers' socio-technical system. The results show how a broad general framing of programmes at the global and national levels must take account of local specificities, in which multiple negotiations and the micro-politics of what is and is not incorporated become more significant. This is when macro-level narratives become recast at the local level, and new, locally specific and socially determined narratives are created.

The analysis extends the multi-level framework and identifies the different narratives within each level that may or may not be in alignment, and outlined the clashes between how the programme was implemented and how the recipients accepted the input packages. Looking at change through this socio-technical perspective embeds technological change within the narratives that frame the local context and, specifically, in the way individuals interact with the technology in their daily lives.

The analysis thus offers an expanded multi-level framework that shows how narratives and resulting systems are nonlinear and dynamic. Moreover, narratives do not exist solely in one given time frame. Dominant narratives on productivity and technological-fixes have persisted through time and resurfaced even when there is evidence to suggest they may not be the best solution for a given locality.

The findings also identified that narratives are not confined to policymakers and can permeate through all levels from decision-making, through the creation of regulations and the method of distribution to end users. These different narratives are often misaligned and can be conflicting, resulting in clashes and mismatches of ideas, knowledge and beliefs on how agricultural inputs are understood and represented. As Mango (2002: 290) states:

> *Most interesting is the fact that local knowledge repertoires clearly question and contest scientific knowledge. Claims made by experts that their products are higher yielding are immediately counter-claimed by local farmers arguing that local maize tastes better, has nicer colours and out yields hybrids.*

What this illustrates is that farmers are not only interested in increases in yields, but they may prefer to accept a lower yield if the variety is more socially acceptable to local cooking techniques, taste preferences, cultural practices and storage attributes. Social interactions thus create localised niches that continue to evolve over time as farmers interact and experiment with the technology and co-construct their dynamic interactions. The findings show that these locally constructed narratives on soil management techniques are created and transformed by individual understanding and social interpretation of technologies and that greater participation in the process can lead to local learning and adaptation.

Overall, the research highlights the difficulties of constructing food security programmes within a Green Revolution narrative focused on delivering a narrow set of technologies. This narrow approach fails to offer site- and context-specific options that are sufficiently dynamic to allow for the complex, diverse and risk-prone farming environments of Africa. I argue throughout the thesis that more attention must be given to the interface between the formulation and delivery mechanisms of input-support programmes (developed at the national and global levels) and the interactions of the technologies at the local level.

Looking to the future: Implications for policy and practice

Just as the Asian Green Revolution programmes were a result of the geo-political, economic and social constructs of the day, the two input-support programmes have emerged from current debates on and policies for technology-led agricultural development. There is a long history of interventions that deliver a set of technological inputs to farmers with donor, government and, more recently, NGO support. However, there is also a history connected to the structural adjustment era, during which the overall funding to the agriculture sector decreased and subsidies went out of favour.

This lack of attention on the agricultural sector has helped to create the current situation and recast the subsidy debate, which is being reconfigured through a new series of arguments. These include the humanitarian goal (set out by the MDGs), the economic growth model (set out by the Maputo Declaration), and the Malawi subsidy argument, which puts the onus on governments to take ownership and invest. Debate surrounding the relative benefits and costs of these approaches continue.

Improved agricultural inputs are an important component of productivity increases. However, it is crucial to understand the social and political aspects involved in the delivery of these technologies. Technology-focused interventions are not created or delivered in a vacuum, but are often affected by political processes that can politicise the technology and, ultimately, have implications on the design and the implementation of the programme. The research shows how the politicisation of hybrid seed and fertiliser technology can result in the framing of policy options that supports not only a

continued dependence on maize but also the promotion of input-oriented support programmes as the primary means to help farmers reach food (maize) security.

Based the research, there are a number of general policy lessons for future technology-focused programmes directed at smallholder farmers that arise from the case studies. Five such policy lessons are highlighted below.

- **Programme design:** it is important that policymakers allow for adequate time and funds to consult with the communities in the design of technology delivery programmes, particularly for programme administration and technology dissemination. Building in flexibility within the programme design to integrate local learning requirements of the community will enhance adaptation.

- **Financing:** it is vital for policymakers to understand the pros and cons of financing subsidies that takes into account the costs of a long-term view to creating local change and adaptation with adequate financing for the necessary institutions and training required for subsidy withdrawal.

- **Timing and sustainability:** policymakers need to build in adequate long-term planning processes to ensure that programmes are able to embrace a long-term vision beyond technology delivery to promote a more comprehensive view that focuses on building the local (and national) capacity and institutions required to take ownership and carry on project activities once funding expires.

- **Training:** there are many dimensions to training programmes, which need to ensure better and more equitable access to knowledge and create local institutions to take ownership of the technology and training. Policymakers need to ensure that this training involves the participation of a wide-range of community members in the design and delivery and include the necessary gender-related dimensions.

- **Monitoring and evaluation:** there is currently no framework for the assessment of socio-technical transitions. Current processes look only at adoption versus non-adoption and miss many of the transitions that take place in between. Therefore,

policymakers must consider creating a wider systems assessment to ensure that adequate and flexible monitoring and evaluation frameworks are integrated throughout the process that takes into account the unique and dynamic social, technical and political aspects of a given locality.

These lessons are not new, but they highlight the fact that programme design and administration have to be target-orientated, time-delimited, geographically focused and sufficiently flexible to allow local project staff and farmers to adapt or adjust the interventions locally. They pose the question of how to incorporate the many different factors in programme design and how to measure success.

The fact that fertiliser is not just a technology, but comes with a whole set of socio-technical configurations, needs to be better understood by programme developers. The concept of success needs to be broadened beyond statistics showing adoption rates or increased yields. Outcome assessment needs to take a systems perspective in which success is related to co-evolution of the technical, economic, institutional and behavioural changes across the multiple levels of socio-technical systems (Berkhout et al., 2008).

Africa is a diverse and dynamic continent that requires a holistic and site-specific approach that takes into account the complexities of the continent to address the multi-dimensional nature of food insecurity. This thesis demonstrates that current perspectives surrounding food insecurity have been 'locked-in' (Brooks et al., 2009) to a certain technology-led approach, which has been further reinforced by policymakers and programme developers.

These narrow policies are constructing particular trajectories for agricultural programming that will have long-term implications for smallholder farmers in Africa. However, these narrow prevailing approaches can be transformed, modified or replaced by more suitable and sustainable alternatives. Berkhout et al. (2008: 10) state:

> *Path dependency and lock-in are overcome because dominant socio-technical trajectories suffer from technical, environmental or social weaknesses that prove unmanageable in the context of dominant designs and systems, and because viable alternatives that offer relative advantages become available.*

Therefore, instituting change requires more flexibility in our development thinking. We need to examine the virtues of multiple pathways and different scenarios for intensification, commercialisation and diversification of agriculture and the rural sector, taking into account the unique and dynamic political, social and institutional conditions present within the continent. Such flexibility will allow unique development trajectories that individual farmers, households and local communities can tailor to their own needs, thereby stimulating experimentation and adaptation.

Encouraging innovation has major implications for smallholders' ability to adjust to changing conditions (climatic or market) thereby reducing their vulnerability to external shocks and allowing them to adapt their farming systems to future realities. In this way, African Green Revolutions will become more dynamic, relevant and sustainable to fit the needs of the numerous livelihoods and regions within Africa.

[173] Photos clockwise - children from Owiti household, Siaya; Mary Oumo, Siaya; Roselina Omoko, Butere; Nathaneil Atulo, Butere; Jane Okoba, Butere; Clementina Ogara, Siaya; Danel Aswani, Butere.

Annex A - Full list of interviewees

National Level Interviews (Nairobi), January 2010 – May 2010		
Organization	**Name**	**Title**
ACDI/VOCA	Steve Collins	Country Director
Africa Enterprise Challenge Fund (AECF)	Gem Argwings Kodhek	Advisor
Africa Partnership Advisors (APA)	Pete Ondeng	Founder and CEO
Alliance for a Green Revolution in Africa (AGRA)	Akin Adesina	Vice President, Policy and Partnerships
Alliance for a Green Revolution in Africa (AGRA)	Bashir Jama	Director, Soil Health Programme
Alliance for a Green Revolution in Africa (AGRA)	Rebbie Harawa	Programme Officer, Soil Health Research and Extension
Alliance for a Green Revolution in Africa (AGRA)	Argent Chuula	Programme Officer
Alliance for a Green Revolution in Africa (AGRA)	Abed Kiwia	Programme Officer
Athi River Mining	K. Srinivasa Rao	Chief Commercial Officer
Athi River Mining	Julius Nyabicha	Technical Sales Manager
Centre for African Bio-Entrepreneurship (CABE)	Hannington Odame	Executive Director
CNFA/AGMARK	Joseph Mwangangi	Director of Agribusiness Strengthening Programme
CNFA/AGMARK	Caleb Wangia	Senior Technical Advisor
DFID	Leigh Stubblefield	Livelihoods Advisor
Earth Institute, Columbia University	Pedro Sanchez	Director, Tropical Agriculture and the Rural Environment Program
Earth Institute, Columbia University	Raffaela Kozar	Community Development Coordinator

European Union (EU)	David Mwangi	Rural Development Officer
Food and Agriculture Organization of the United Nations (FAO)	Kithinji Mutunga	Advisor
Food and Agriculture Organization of the United Nations (FAO)	Paul Omanga	National Consultant – Crop Production
Farm Input Promotions Africa (FIPS)	Paul Seward	Managing Director
German Agency for International Cooperation (GIZ)	Antti Seelaf	Senior Advisor
Government of Kenya /Ministry of Agriculture	Ken Ayuko	Director, Agriculture Policy
Government of Kenya /Ministry of Agriculture	Philomena Chege	Director, Njaa Marafuku Kenya Programme
Government of Kenya /Ministry of Agriculture	Philip Makheti	Director, NAAIAP Programme
Government of Kenya /Ministry of Agriculture	Rymer Ndengu	Deputy Coordinator, NAAIAP
Government of Kenya /Ministry of Agriculture	Dixon Kiptoni Korir	NAAIAP Input Promotion Officer
Government of Kenya /Ministry of Agriculture	Esther Musyoka	NAAIAP Monitoring and Evaluation Programme Officer
Government of Kenya /Ministry of Agriculture	Jacob Mutua	NAAIAP Marketing Officer
Government of Kenya /Ministry of Agriculture	Zaweria Thuku	NAAIAP Credit Finance Officer
World Agroforestry Centre (ICRAF)	Frank Place	Economist, Theme Leader – Land and People
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)	Richard Jones	Assistant Director
IFDC	Rob Groot	Director, East and Southern Africa Division

IFDC	Balu Bumb	Advisor
Kenya Agricultural Research Institute (KARI)	Festus Murithi	Director, Socio-Economic and Applied Statistics
MDG Centre, East Africa	Denis Haraszko	Advisor
MDG Centre, East Africa	Glenn Denning	Director
MDG Centre, West Africa	Rafael Flor	Agriculture and Value Chain Development Advisor
Monsanto	Kinyua Mbijjewe	Government and Public Affairs Lead – Monsanto Africa
Rockefeller	Betty Kibaara	Research Associate
Seed Industry Representative	Seed Representative	Manager
Swedish International Development Agency (SIDA)	Japhet Kiara	Programme Officer, Agriculture and Rural Development
SNV	Stuart Worsley	Country Director
School of Oriental and African Studies (SOAS), University of London	Colin Poulton	Research Fellow and Managing Editor of Food Policy
Technoserve	Fred Ogana	Country Director
Tegemeo	John Olwande	Research Fellow
United Nations Development Programme (UNDP)	Danston Ondanchi	Head of the UN Resident Coordinator Secretariat
United Nations Development Programme (UNDP)	Phil Dobie	Director, UNDP Drylands Centre
USAID	Allen Flemming	Director, Agriculture, Business and Environment Office
USAID	Julius Kilungo	Program Specialist
USAID	Makeda Tsegaye	Pastoral Development Program Manager
Western Seed Company	Saleem Esmail	Chief Executive Officer
World Food Programme	Joao Manja	Head of Vulnerability

		Analysis and Mapping
World Bank	Andrew Karanja	Agricultural Economist

District Level Interviews (Siaya and Butere Districts), April 2009 – September 2009		
Organization	**Name**	**Title**
Millennium Villages Project	Eliud Lelerai	Database Manager
Millennium Villages Project	Florence Ashioy	Agriculture facilitator Lihanda Sub-location
Millennium Villages Project	Hannington Nyando Owiti	Agriculture Facilitator Nyandiwa Sub-location
Millennium Villages Project	Herine Okoth	Agriculture facilitator Sauri Sub-location
Millennium Villages Project / Millennium Farms	Anginya Tabu	Programme Coordinator, Millennium Farms
Millennium Villages Project	Jessica Masira	Community Coordinator
Millennium Villages Project	Patrick Mutuo	Science Coordinator
Millennium Villages Project	Willy Diru	Agriculture Coordinator
Government of Kenya/Ministry of Agriculture	Edward Wange Ziro	Butere District Agriculture Officer (DAO)
Government of Kenya/Ministry of Agriculture	Daniel Chege	Butere District Agricultural Development Officer (DADO)
Government of Kenya/Ministry of Agriculture	Joab Aukah	Khwisero Divisional Crops Development Officer
Government of Kenya/NAAIAP	Musa Justius Okinda	Farmer Representative, Kisa West Location
Government of Kenya/NAAIAP	Wycliff Ateka	Farmer Representative, Kisa Central Location
Government of Kenya/NAAIAP	Richard Shikumo	Farmer Representative, Mulwanda Location
Government of Kenya	David Ngwawe	Chief, Kisa West Location

Government of Kenya	Simon Achero	Assistant Chief, Doho Sub-location
Government of Kenya	Albert Amoni	Assistant Chief, Emutsasa Sub-location
Government of Kenya	Alexander Malika	Assistant Chief, Khushiku Sub-location
Village leader	Amos Orony	Village Elder, Emutsasa Village
Village leader	Gilbert Libuyi	Village Elder, Emuli Village

Private Sector Agro-dealers interviewed (Khwisero and Yala Division), August 2009		
Business name	**Name of interviewee**	**Location of shop (town)**
Yala Farm Land	Veronica Odongo	Yala, Yala Division
Farmers Shop	Edward Oyer	Muhanda, Yala Division
Eden Agrovet	William Oyoo Ouda	Nyangweso, Yala Division
New Safari Shop	Daniel Onyango Oyoo	Nyangweso, Yala Division
Oasis Farmers Shop	Lilian Oluoch	Dudi, Yala Division
Uzima Agrovet	Nicholus Were	Mutumbu, Yala Division
Lunza Hardware	Margret Abong'o	Wagai, Yala Division
Sawa Agrovet	Seline Awuor Ogalla	Wagai, Yala Division
Elmart Agrovet	George Ochieng'	Luanda, Yala Division
Mkulima Centre	Jacob On'gare	Luanda, Yala Division
New Bridge Agro-vet	Jane Musimbi	Khumusalaba, Khwisero Division
New Daktari Agro-care	Francis Okachia	Khumusalaba, Khwisero Division
Khushiku General Stores	Peter Ambundo	Khushiku, Khwisero Division
Munyisu Agrovet	May Munyikui Simba	Khwisero, Khwisero

		Division
Farm Care	Joseph Nyogi	Khwisero, Khwisero Division
Witinye Multi-Purpose Centre	Anne Kataka	Khwisero, Khwisero Division
Luma Agrovet	Luka Erembo	Khwisero, Khwisero Division
Survival Shop	Francis Lubanga	Khumailo, Khwisero Division

Household level interviews (Siaya and Butere), May 2009 – June 2010		
Name of interviewee(s)	**Sub-location**	**District**
Teresa Nyambuenya / Jared Nyambuenya Ongiyo	Lihanda	Siaya
Abigael Awino	Lihanda	Siaya
Joseph William Odur	Lihanda	Siaya
Florence Akinyi Obong'o	Lihanda	Siaya
Sarah Abiero Ongor	Lihanda	Siaya
William Omondi Haja	Lihanda	Siaya
Elias Ouda Obiero	Lihanda	Siaya
Rael Atieno Nyamulo	Lihanda	Siaya
Jane Akinyi Ochieng	Lihanda	Siaya
Pamela Awuor Olila	Lihanda	Siaya
George Opondo Were	Lihanda	Siaya
Charles Omolo / Sara Adiambo Omollo	Lihanda	Siaya
Elsa Aketch Oluoch	Nyandiwa	Siaya
George Otieno Radier	Nyandiwa	Siaya
Dismas Ochieng' Okello	Nyandiwa	Siaya
Anton Oloo Oketch	Nyandiwa	Siaya
Sulmena Opiyo Achola	Nyandiwa	Siaya

John Jow Owuor	Nyandiwa	Siaya
Hellen Anyango Ogoma	Nyandiwa	Siaya
Risper Ajwang Nyandat	Nyandiwa	Siaya
Claris Adhiambo Omollo	Nyandiwa	Siaya
Mariko Nyol Ogutu / Wilfrida Opondo Nyol	Nyandiwa	Siaya
Mathayo Wangara Olala / Rispar Wangara	Nyandiwa	Siaya
Jackline Auma Onyango	Nyandiwa	Siaya
Jared Ouma Odera / Rebecca Ouma	Sauri	Siaya
Laban Onyango Buyu	Sauri	Siaya
Perez Odinga Orera / Caroline Akinyi	Sauri	Siaya
Elisabeth Odera	Sauri	Siaya
Eunice Juma Owino	Sauri	Siaya
Anastasia Awar Oyugi	Sauri	Siaya
Jessica Arua Ateweyo	Sauri	Siaya
Beatric Atieno Ayayo	Sauri	Siaya
Angeline Anyango Otieno	Sauri	Siaya
Mary Atieno Ouma	Sauri	Siaya
Gideon Owiti Achieng / Joseline Owiti	Sauri	Siaya
Teresa Adhiambo Ogonda	Sauri	Siaya
Emily Ariaka / Richard Ariaka	Khushiku	Butere
Rienhard Omoto Amayayi	Khushiku	Butere
Rose Amanya	Khushiku	Butere
Daniel Aswani Ongalo	Khushiku	Butere
Zadock Shikule	Khushiku	Butere
Peter Emali Ambondo	Khushiku	Butere
Julius Ambunya Mwando	Khushiku	Butere
David Aswani Matokho	Khushiku	Butere
Thomas Malika Amboko / Lidya Malika	Khushiku	Butere

Grace Osale	Khushiku	Butere
Catherine Amakome Olaka	Khushiku	Butere
Roselinda Matendechere Omoko	Khushiku	Butere
Alice Achieng' Nandwa	Doho	Butere
Ibrahim Okelo	Doho	Butere
John Ougoh Adeya / Selphine Akoth Ougoh	Doho	Butere
Joseph Ndong'a Esala / Elisabeth Auma Ndong'a	Doho	Butere
Winfred Aketch Okun	Doho	Butere
Jane Ogoye Agina	Doho	Butere
Peter Odera Wakolo	Doho	Butere
Joice Oriko Hagai	Doho	Butere
Benadict Ashiono Atubukha	Doho	Butere
Monica Ananda Okinda	Doho	Butere
Nathaniel Kuya Atulo / Philis Kuya	Doho	Butere
Spensa Ouma Owino	Doho	Butere
Michael Indimuli Askoye	Emutsasa	Butere
Philis Ondong'i Amakuyi	Emutsasa	Butere
Phanis Omina Oyombe	Emutsasa	Butere
Rose Webo Masakhwe	Emutsasa	Butere
Melisa Eshiatia Shikule	Emutsasa	Butere
Turphosa Omulongi Nyawalo	Emutsasa	Butere
Sara Nyawate Aswa	Emutsasa	Butere
Jane Oronga Okoba	Emutsasa	Butere
Barnabas Shikanda Angoya	Emutsasa	Butere
Habil Akhabochi / Milcah Awinja Akhabochi	Emutsasa	Butere
Grace Ayuma	Emutsasa	Butere
Beatrice Were Libuyi	Emutsasa	Butere

Focus group meetings		
Group Description	**Date**	**Location**
MVP recipients, including women farmers, youth groups and village leaders (20 people)	April 16, 2009	Nyandiwa Sub-location
MVP recipients, including women, youth groups and village leaders (25 people)	April 16, 2009	Lihanda Sub-location
MVP Agriculture Representatives and village leaders (7 people)	April 22, 2009	Lihanda Sub-location
MVP recipients, including women farmers, youth groups and village leaders (30 people)	April 23, 2009	Sauri Sub-location
MVP Agriculture Representatives and village leaders (15 people)	April 24, 2009	Nyandiwa Sub-location
MVP Agriculture Representatives and village leaders (12 people)	April 28, 2009	Sauri Sub-location
NAAIAP recipients, plus additional women farmers and village leaders (12 people)	June 10, 2009	Khushiku Sub-location
NAAIAP recipients, plus additional women farmers and village leaders (11 people)	June 11, 2009	Doho Sub-location
Previous NAAIAP recipients (5 people)	June 15, 2009	Wambuleshe Sub-location
NAAIAP recipients, plus additional women farmers and village leaders (10 people)	June 17, 2009	Emutsasa Sub-location
Previous NAAIAP recipients (13 people)	July 6, 2009	Ebuchero Sub-location

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